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Contributions to the Herpetology of Kouf National Park (NE-Libya) and Adjacent Areas

By **Hans Hermann Schleich**

Contents

[1] In the present paper the more common use of the generic name *Coluber* instead of *Haemorrhois* is maintained.

Abstract

Herpetological surveys were carried out by RESETAR (1981) between September 25, 1981 and December 12, 1981 and by myself from April 1, 1983 to August 30, 1983.

In this final report all species of amphibians and reptiles collected in Kouf National Park and its adjacent areas are mentioned and the data, descriptions and wildlife observations, together with the distributional maps of the herptiles of the park area, are compiled. – In the proposed 100,000 ha park area 2 amphibian, 3 turtle, 10 lizard and 7 snake species were found and described. For the adjacent areas, surrounding the region of the watershed, 1 further turtle species *(Testudo [P.] kleinmanni)*, 2 further lizard species *(Stenodactylus sthenodactylus sthenodactylus, Eumeces schneideri algeriensis)* und 2 further snake species *(Spalerosophis diadema, Cerastes* sp.) could be added.

General descriptions and information on the park are given, and ecological data summarize the information on the biology of the species mentioned.

Foreword

Special requests were made by the Libyan authorities and by the ACSAD management. In response to these requests, I have studied the distribution of the amphibians and reptiles as far as possible and given descriptions and comments on their biology. Unfortunately no further detailed studies were required on certain aspects as I was told to leave those to the future park's personnel. As for the need to maintain reptiles for exhibitional purposes, a separate proposal could be supplied if asked for.

This report has been prepared by the International Union for the Conservation of Nature and Natural Resources (IUCN) with financial assistance of the Arab Center for the studies of arid zones and dry lands (ACSAD) and became now partly modified for this publication.

The presentation of the material in this document does not imply the expression of any opinion whatsoever on the part of IUCN or the author concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Acknowledgements

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facilitated my studies and stay in Libya very much. – From the El Fateh University at Tripoli I received helpful information and comparative study material.

Last but not least, I wish to express deep gratitude to all the people and organizations that have facilitated this survey. The studies and results would not have been possible without the support of IUCN and ACSAD who provided funds and a lot of colleagual help for this research. Many other IUCN and ACSAD staff members helped in various ways, and I also wish to thank all those who helped me and whom I have not mentioned here.

Introduction

The Kouf National Park (KNP) is located in Jebel Akhdar (Green Mountain) in northeast Libya (see fig. 1) between latitudes 32°37′ and 32°49′ N and between longitudes 21°20′ and 21°35′, with a surface of 32,122 ha. In spite of the fact that the KNP's area became restricted to a size of about 9,000 ha (see fig. 1) the studies of the herpetology were extended to the former supposed area of about 100,000 ha. The reasons for this extension were the higher diversity of species in this area and the more varied ecological and climatological conditions of the area.

The geology of this area consists of paleogene formations covering most of the KNP's area and of eocene and upper oligocene limestones, dolomites and marls. Thus a typical carstic mediterranean landscape is presented in the park's area.

The vegetation units might be generally characterized as maquis forests, Cupressus/Juniperus forests, garigue and littoral vegetation and rolling steppe lands mainly with Artemisia. – The littoral vege-

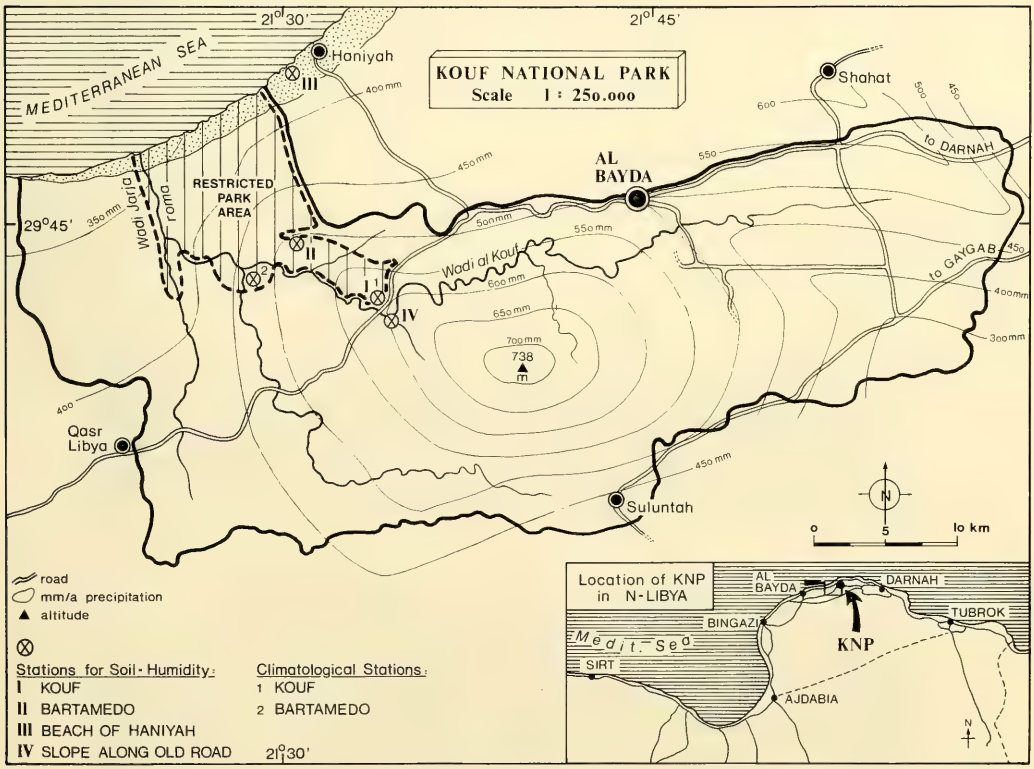


Fig. 1 Geographical situation of Kouf National Park and adjacent areas around watershed. Beside the restricted park area (dotted) the two principal climatological stations and the stations from where the soil conditions are taken are indicated.

tation is found along the coastal shores and their hindlands up to an altitude of about 20 m above sea level with shrubs and bushes consisting mainly of Limoniastrum monopetalum, Tamarix and other xerophytes. The maquis and garigue vegetation is typically represented from an elevation of 10 m up to 300 m changing from the littoral vegetation. It consists of shrubs, herbs and bushes (Sarcopoterium, Juniperus, Pistacia, Olea and Arbutus). The deep wadi valleys show some forests with high trees of Cupressus and Juniperus. For the southern range south of the watershed boundary an area like an Artemisia steppe is typical.

The vegetation with its climatological aspects is representative for typical ranges for the herptile distribution. One can consider three main general habitat areas for the herpetological ranges:

a) the coastal area with sandy beaches and backlands with a precipitation of more than 300 mm and special vegetation comparable to semi-desert or "para-desert" conditions

b) the central park ranges with a more dense vegetation belonging to maquis and forests

c) the semi-desert Artemisia steppe-like area in the vicinity of the southern watershed boundary.

Climatologically one can conclude from the "Turkish studies" (1979, I: 8)[1] that the climate for KNP may be classified as being "dry, subhumid, mesothermal, with excess rainfall in winters, oceanic". The important influences for the climatic conditions are the Mediterranean Sea in the north and the great Libyan Desert in the south, influenced by the topographical situation of each area. As for the study of herptiles and their important climato-ecological aspects, data were compiled for Chapter 3 from the data registrations of Ing. S. Rifaat and Mahmud Yasin during an average year from January 1982 to January 1983: temperature, sunshine, humidity and precipitation; soil temperatures and soil moisture contents.

General Aspects

A. Geology, Climatology, Vegetation and Abundance of Herptiles

First the idea of a dependence of the herptile distribution on the different elevations or topography of the area were checked. It was established that there are three different main ranges for preferred habitat selections according to the physical conditions. These are the geological-topographical, vegetational and also climatological differentiated areas like the coastal plains and first terraces, the wadis and platforms, and finally the watershed and adjacent areas. The first and last ranges mentioned both have warmer climatic conditions, less rainfall and circummountainous relations similar or comparable in their herpetofaunal assemblages.

The ranges can roughly be characterized and subdivided as follows:

1. Coastal Plains and First Terraces (fig. 2, 3)

Herpetofaunal assemblages: *Agama, Acanthodactylus boskianus asper, Mesalina, Malpolon, Cerastes* (unproved) as typical indicators for this area with occasional or temporary visitors such as *Caretta, Testudo g. graeca, Ophisops, Chamaeleo* and *Naja.*

Characteristic features:

a) Coastal shore:
- sandy beach, overblown limestone hills of the Darnah formation
- scarce or no vegetation

[1] Unpublished internal Park Information.

– less than 300 mm average annual precipitation
– soil moisture, see Chapter 3.

b) Empty foreshore:
– characteristics of a), but lacking vegetation.

c) Sebkahs:
– winter-flooded flat evaporation pans with complete dry-out of Ayn Zargah during the summer period
– dwarf shrubland with Limoniastrum monopetalum, Tamarix and Sarcopoterium.

Fig. 2 Coastal plains and first terraces; photograph taken on descending road from Qasr Libya to the North.

Fig. 3 View of KNP from Sebkah Ayn Zargah and to the South of Jebel Akhdar.

d) Range between sandy and rocky (clay soil) area up to about 100 m elevation:
- "first and second terrace with shrubland"
- about 300 mm average annual precipitation
- Darnah and Apollonia limestone, red rendzinas; flat to gentle sloping
- Sarcopoterium bushes, shrubland and woodland.

2. The Wadis and Plateaus (fig. 4)

Herpetofaunal assemblages: *Testudo g. graeca, Chamaeleo, Ophisops, Mabuya, Chalcides, Tarentola, Hemidactylus, Naja, Malpolon, Psammophis, Macroprotodon* and *Coluber algirus*.

Characteristic features:

a) Third and fourth terrace:
- between 300 and 400 mm average annual precipitation
- gently sloping with narrow wadis
- between 100 and 300 m altitudinal range
- Darnah and Apollonia limestone with red clay soils, shrubland, woodland and forests.

b) High terraces and deep incised wadis:
- consisting geologically of Darnah, Abraq and Beida limestones with mostly red clays and rendzinas
- from flat and gentle slopes with wide valleys to steep steps and canyons
- altitudinal range up to approximately 700 m
- Mediterranean macchia and wood lands with Juniperus, Cupressus, Olea, Trisetum and agricultural lands
- up to 700 mm average annual precipitation (according to the observations made by S. Rifaat during 1981/82).

3. The Watershed Areas and Flatlands South and East of El Beida (fig. 4, 5)

Fig. 4 View from the highest area of KNP, close to the main entrance at bridge and main road.

Fig. 5 Southern area of Djebel Akhdar leading into drier semidesertic areas. Photograph shows clearly the decline of vegetation to the South.

Herpetofaunal assemblages: *Testudo graeca terrestris, Ophisops, Chalcides, Mabuya, Tarentola, Naja, Malpolon* and *Psammophis.*

Characteristic features:

a) High terraces of Darnah and Beida:
- limestone formations with red loamy clays and rendzina
- low sloping, rolling country, moderately steep with cultivated land, grasslands, shrub and dwarf shrub lands with few forests
- Juniperus, Olea, Sarcopoterium, etc. are common
- average annual precipitation rate between 350 mm and 500 mm.

b) Southward the watershed boundary to Mekhili and south of Suluntah:
- characteristic herpetofaunal elements: *Testudo (P.) kleinmanni, Cerastes, Eumeces, Stenodactylus, Agama, Acanthodactylus, Chalcides* and *Psammophis*
- rolling Artemisia steppe with semi-desert to desert conditions.

B. Methods and Terminology

All the KNP's area was studied while the main interest has to become concentrated on the 32 ha area with its included restricted 9 ha area. Special field trips were made to cover the areas for a representative knowledge of the different habitats. Most of the lizards and amphibians could have been determined just by field observations. For the snakes the more common species like *Malpolon, Naja* and *Psammophis* were mostly also just registered by field observations; doubtful records were either not mentioned or were able to be proved after catching the specimens. For the restricted 9 ha area the attempt to cover all this range by excursions was made.

As for the snakes, for example, it seemed – after the experiences of the last months' studies – much better to me to catch them during the cooler winter period when they are hidden under stones for instance.

Distributional maps for most of the species were based on record plotting.

There were very interesting observations made of species on the roads, of road-killed specimens or moving (basking, crossing) specimens. There were different frequencies at different periods of the year for recording certain spe-

cies when they could have been seen more often or dominant, e. g. on the roads. Of course, toads were always found on roads after rainfalls or later in the year sitting on the asphalt at night. There was a high mortality rate for tortoises killed on the roads in May and June, and during this time they were dominant among all other species killed on roads. Snakes, mostly *Naja, Psammophis* or *Malpolon* were found killed on roads from June till the end of my stay at the end of August. Chamaeleons were found in their masses from mid-July to August, mostly during late morning, crossing the roads. Outside KNP, *Agama mutabilis* was found on roads warming and basking until 10 h 00 or at the latest 11 h 00 during these months. All amphibian and lizard specimens were caught mostly by hand; other methods are mentioned by RESETAR (1981) or HERBERT (1981).

For the KNP's collection there were some difficulties in re-identifying the labelling of the specimens with their accession numbers and with their catalogue numbers. Thus, as the accession numbers were the running ones they were taken for the citations here. The preserved specimens after 1981 were catalogued with their running accession numbers and the collection year like 1981 or 1983 as in other museums' collections. The recent status of the museum's collection was an extremely bad one, thus I informed the park's direction to take more care in future of the worthwhile preserved material.

C. Abbreviations

KNP	Kouf National Park
ZSM	Zoological State Collection, Munich
ACSAD	The Arab Center for the Studies of Arid Zones and Dry Lands
IUCN	International Union for Conservation of Nature and Natural Resources
WWF	World Wildlife Fund
TNTM	Tripoli National History Museum
FUT	El Fateh University, Tripoli

The Amphibians and Reptiles of Kouf National Park and Adjacent Areas

Chapter 1 – Amphibia

1.1 Bufonidae

Bufo viridis Laurenti 1768

Material and Description

Collected specimens: 44

- KNP 1981/144, 196, 213–215, 246–253, 260–267, 271, 273, 281–283, 301, 335, 338, 363, 364, 392, 393, 414, 416, 429–432, 440, 461, 464, 465, 475, 476, 489, 490, 492, 494
- ZSM 1983/144

Many specimens were observed during my working period in Libya. I tried to bring live specimens for comparative electrophoretical serological studies to Germany but failed because of the terribly bad treatment of my luggage at the Libyan airport at Tripoli. The material seemed, at least phenetically, to be very interesting. The specimens showed colour patterns between *Bufo regularis, viridis* and *calamita,* thus sometimes there seemed to be no obvious method of easy identification. There occurred colour patterns with bands or spots with spots smaller or larger than the size of tympanum and other variable features. RESETAR (1981: 6) reported: "Three specimens ... were completely white like albinos but had normally spotted hindlimbs but had no spots anywhere else and had a light greenish tan coloration."

Most of the toads had been observed either during night on asphalted roads or after rainfall (e. g. May 9, 1983, 18h30, road to Massah; the body temperature of this specimen was 16.6° C at an air tem-

Tab. 1 Classification scheme for amphibians and reptiles from Kouf National Park and adjacent areas (with vernacular names).

CLASS	ORDER	SUBORDER	FAMILY	SPECIES	ENGLISH NAME	ARABIC NAME
AMPHIBIA	ANURA		Bufonidae	Bufo viridis	Green toad	Duvda
			Ranidae	Rana ridibunda	Marsh frog	Duvda
REPTILIA	TESTUDINES		Testudinidae	Testudo graeca graeca	Spur-thighed tortoise	Fakrunah
				Testudo graeca terrestris		Fakrunah
				Testudo kleinmanni	Egyptian tortoise	Fakrunah
			Cheloniidae	Caretta caretta	Loggerhead turtle	Fakrunah
	SQUAMATA	SAURIA	Gekkonidae	Tarentola mauritanica	Moorish gecko	Abu brace
				Hemidactylus turcicus	Turkish gecko	Abu brace
				Stenodactylus sthenod. sthenodactylus	Spotted gecko	
			Chamaeleonidae	Chamaeleo chamaeleon chamaeleon	Common chamaeleon	Herbah
			Agamidae	Agama mutabilis	Pale agame	Bukasheesh
			Scincidae	Eumeces schneideri	Gold skink	
				Chalcides ocellatus	Ocellated skink	Reddaeeh
				Mabuya vittata	Bridled skink	Reddaeeh
			Lacertidae	Ophisops elegans	Snake eyed lizard	Zlumumiyah
				Acanthodactylus boskianus asper	Bosc's lizard	Zlumumiyah
				Acanthodactylus pardalis		
				Mesalina guttulata guttulata	Small-spotted lizard	Zlumumiyah
		SERPENTES	Boidae	Eryx jaculus jaculus	Javelin sand boa	Hanish
			Colubridae	Coluber algirus	Algerian whip snake	Hanish
				Coluber rogersi	Roger's snake	Hanish
				Spalerosophis diadema	Diademed sand snake	Hanish
				Macroprotodon cucullatus cucullatus	Medirerranean hooded snake	Hanish
				Malpolon monspessulanus insignitus	Montpellier snake	Hanish
				Psammophis schokari schokari	Afro-Asian sand snake	Hanish
			Elapidae	Naja haje haje	Egyptian cobra	Hejshah
			Viperidae	Cerastes sp.	Sand viper	

perature of 14°C and soil temperature of 16.2°C; the relative humidity measured was 56.5 %). But most of the specimens were found in cisterns and at the sebkahs.

The taxonomical status is in accordance to FROST (1985).

Biology

On around May 10, 1983, I observed still one mating couple in amplexus in a loamy small fresh water pond in front of the spring at Massah, west on the road to Kufanta. While few tadpoles could be seen in those cisterns mainly adult specimens seemed to use them as refuges. Beside such ponds the highest amount of reproductivity could be observed to take place in the sebkahs along the coast line. During May, June and July many tadpoles at different stages of metamorphosis were found in Sebkah Ayn Shagigah. Ing. S. Rifaat, an hydrologist who frequently visited the sebkahs over several years, reported to me that he had seen tadpoles all year round. HERBERT (1981: 24) mentioned thousands of 10 mm long recently metamorphosed toads in Ayn Ayuin in May, 1981. It is interesting to note the toads' tolerance to salinity, both in soils near the beaches or even during the reproduction and development in the sebkahs (see data below). RESETAR (1981: 6) reports that one specimen found in the dunes between the eastern Park boundary and Sebkah Ayn al Zargah was "moist, covered with sand and coming out after a light rain". Another interesting statement was his observation of complete and also partial albinos found at a locality 2.3 miles west of Kufanta in Roman ruins.

For the biology of reproduction and salt tolerances of both tadpoles and toads, the following data (tab. 2, 3) of the sebkahs (submitted by S. Rifaat) seem worth citing here.

Tab. 2 Water conditions of sebkah Ayn Shagigah with three fresh water springs (1, 2, 3) on its southern shore – in spring (10. may 1983).

	1	2	3
Temperature (°C)	24.3	23.8	21.5
eC	8,750 µmohs	11,500 µmohs	11,250 µmohs
pH	7.60	7.45	7.25

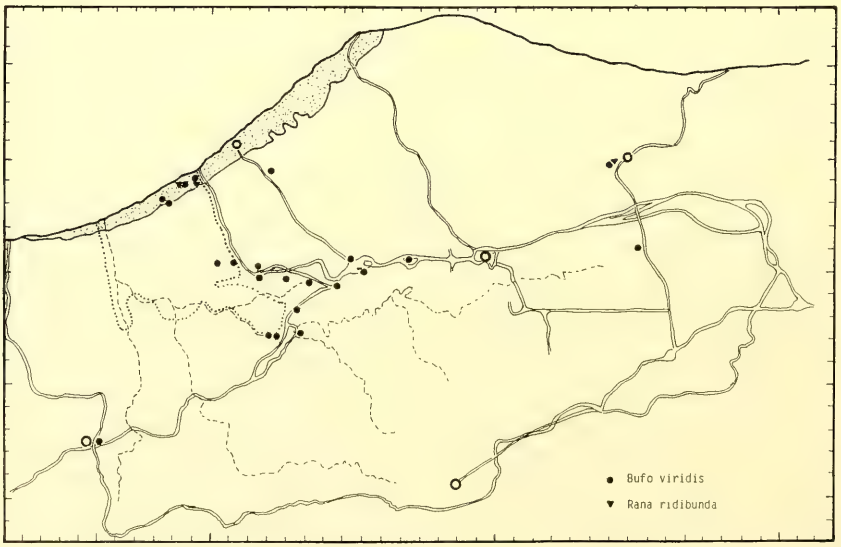
Tab. 3 Maximal annual salt concentrations in the sebkahs.

Sebkahs	Date	pH	eC*	tts
Ayn Shagigah	03.01.83	7.65	24,200	15,560
	02.05.83	7.85	174,990	111,997
Ayn Zargah	03.01.83	7.45	62,300	40,059
(no springs)	02.05.83	7.90	180,280	115,381

(*) eC/1,000: µmohs/640 ≙ ppm salt content - tts).

Distribution in KNP (map 1)

Water cisterns in KNP are together with the sebkahs along the park's coast the most important localities for an almost steady abundance of the green toad. Adult specimens can also be found all over the



Map 1 Observation and collecting sites of Amphibia *(Bufo viridis* and *Rana ridibunda)* around KNP.

park but are seen mostly occasionally after rainfalls or during the night. South of the KNP, I found *Bufo viridis* in a semi-desert/desert area in a recently dried out natural limestone cistern. Other specimens were brought to me by Mr. Helal on June 15, 1983 from a cistern at Dernah.

1.2 Ranidae

Rana "ridibunda" Pallas 1771

Material and Description

Collected specimens: 39; KNP 1981/div. No.

Four specimens could be observed in cisterns while most specimens were seen at the spring at Cyrene ruins, in Shahat; other were found at the Darnah river. The brown or green coloured frogs show similar features for *Rana ridibunda.* According to FROST (1985: 512), the status of North African frogs of the *Rana esculenta* group is uncertain.

Biology

RESETAR (1981: 7) observed and captured the frogs "in shallow waters with substantial aquatic vegetation" at the southern edge of Ayn Zargah. I found some adult specimens and many tadpoles at every stage of metamorphosis at the spring and in ponds of the Cyrene ruins at Shahat. According to RESETAR (l. c.) frogs and their tadpoles were seen in mid-November 1981. After May I could not record any further specimens in the sebkahs. Thus it might be assumed for *Rana ridibunda* that according to the measurements of the salt content and its increase during the late season the sebkahs may be no more adequate for survival or reproduction.

Apart from one huge cobra living close to the springs at Cyrene, no evident predators were seen. Cannibalism might be expected.

Distribution in KNP (map 1)

Although the presence of frogs in some cisterns could be proved constant, records for *Rana ridibunda* seem to be restricted to the sebkahs' springs during winter and spring time. A steady presence of frogs seem to occur at the spring and its fresh water ponds at Cyrene ruins at Shahat. Most of the afore mentioned cisterns will show single specimens or small populations of frogs or toads.

Chapter 2 – Reptilia

2.1 Testudines

2.1.1 Testudo graeca graeca Linnaeus 1758

Material and Description

Collected specimens:
- 11 KNP 1981/184, 192, 216, 290, 316, 317, 463, 466, 488, 497, 510
- 1 ZSM 1983/108

Many specimens were observed, 25 were kept for observation under semi-natural conditions[1] for three months and were released thereafter. The allometric measurements and the ecological records were taken from these living specimens.

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[1] For the facilities provided herefore I am grateful to Dr. Masoker's help.

The shell of *Testudo graeca graeca* is rather equally domed, the hind wedge of the carapace (Marginals 9–11) slightly exposed. The plastral front lobe before the axillary slit is obviously cranio-dorsally curved and the gular beak protuberated. In some specimens a doubled gular furrow is present. In both sexes the xiphiplastron is movable, slightly more in females. Femoral pores are also present in both sexes, osteoderms seem to occur only on the forelimbs. Annual growth rings are well established. Metric proportions are shown in table 4.

Tab. 4 Metric proportions of some *Testudo graeca graeca* specimens, kept under seminatural conditions at KNP for observations.

Field No	Sex	CL	CWM	PLM	XWA	XLM	SH
1	F	18.5	12.8	17.0	8.4	4.9	9.5
2	M	16.5	12.0	15.5	7.6	3.6	8.0
3	M	16.0	11.5	15.1	7.8	4.4	7.5
4		7.4	5.8	6.8	3.6	1.7	4.2
5		6.1	4.9	5.4	3.1	1.2	3.4
6	F	20.5	14.7	18.6	9.7	5.0	10.5
7	M	14.0	10.0	11.8	6.3	3.0	6.5
8	F	14.8	11.2	13.9	7.2	3.8	8.6
9	F	16.8	12.3	14.5	7.4	3.5	8.1
10	F	18.8	13.7	17.1	8.5	4.4	9.0
11	F	12.0	8.9	10.5	5.6	2.5	6.2
12	F	12.2	9.0	11.4	5.9	2.9	6.6
13	F	10.1	7.6	9.3	4.8	2.3	5.4
14		14.6	10.9	14.1	6.7	3.7	7.4
15	F	16.4	11.9	15.4	7.8	4.2	8.6
16	F	18.9	13.4	17.4	8.9	4.4	9.8
17	M	6.0	4.8	5.3	3.0	1.2	3.5

Sex: M = male, F = female
CWM: Carapace Width Maximal
XWA: Xiphiplastron Width Anterior
SH: Shell Height
CL: Carapace Length
PLM: Plastron Length Marginal
XLM: Xiphiplastron Length Median

The colouring is yellowish-brown with mostly more than half of the shields black-coloured. The dark colour distribution is mainly located in the middle and marginal areas of the shields. On the plastron it may be irregularly but bilaterally symmetrical. Most of the specimens are yellow-dotted on the central part of the head.

Sexual dimorphism: Both sexes have moveable xiphiplastra but in males the range of the pygal and of the peripherals 11 is strongly convex curved. The tail length in males is about twice that of the females.

In females the femoral tubercles seem to be somewhat enlarged. A further sexual dimorphistic feature is, that in males the xiphiplastral or anal tips nearly reach the marginals 11 which they never do in females; also the plastron in males is, of course, more concave.

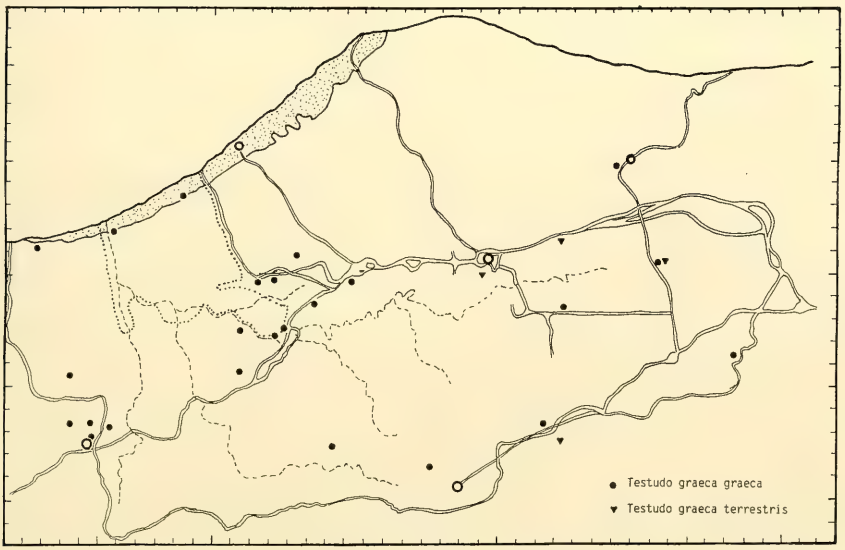
Biology

Many observations on the biology of the tortoises were made during my stay at Kouf but it is not possible to include them all in this report. The results of these observations may be published as a separate document.

Mating activity was reported by RESETAR (1981) and HERBERT (1981) during October and November 1981. The observation of ramming specimens as far as studied now cannot be regarded as proof of mating behaviour. During May and August I observed that ramming occurred among females connected with territorialism during their oviposition period and acts against both sexes. None of the males were ramming at this time. Real mating took place in the weeks between late April and early May. May and June were the months with the highest activity of the tortoises outside their hiding places and the time when most of them were registered on field trips. At the end of June I observed intensified intra-sexual ramming among females, or mainly from females against both sexes coming into their range. A few days later, in the last week of June (06.26.83) I observed the first tortoise digging an egg pit, and finally setting six eggs on June 28, 1983. The weight of the eggs laid in this period were between 10.6 and 28.5 g at a size of 2.9×2.6 to 3.9×3.0 cm. Between five and seven eggs were laid. RESETAR (1981: 8) found hatchlings still with their egg tooth visible on October 13 and November 30, 1981.

Distribution in KNP (map 2)

I found *Testudo graeca graeca* in all areas from the middle to the west of Jebel Akhdar and also in the coastal areas of the Sirte desert. In KNP itself, I found the tortoise to be most common between the crest of Jebel Akhdar and the coastal elevations, though of course not on the beaches or in sandy areas. There was no special habitat preference seen in this range. The tortoises were found in wadis, cultivated land and in the Mediterranean macchia.



Map 2 Observation and collecting sites of tortoises *(Testudo g. graeca, T. graeca terrestris)* in and around KNP.

Forms south of El Beida-Shahat or around this area seem phenetically to intergrade with *Testudo graeca terrestris*.

2.1.2 **Testudo graeca terrestris Forskål 1775**

Material and Description

Collected specimens:
- 2 KNP 1983/...
- 2 ZSM 1983/109

According to Wermuth & Mertens (1961) the general features for this subspecies are a rather high domed carapace and a head with yellow dorsal and lateral colouring. The specimens were bigger than the biggest *Testudo graeca graeca* found in KNP. In fact the shell is somewhat more elongated and higher domed than that of the latter one. Further features are: movable xiphiplastron in both sexes and yellowish colouring with very few black markings on carapace and plastron – obviously less than in *Testudo graeca graeca*. The laterals and marginals just show the remains of dark colour spots on their former embryonal aureole.

Biology

The four collected specimens were kept for several months in captivity at the park, together with *Testudo graeca graeca*. There was no obviously different behaviour between *graeca* and *terrestris*. One could assume that the behavioural interactions were closer and more frequently intrasubspecific than intersubspecific.

Distribution in KNP (map 2)

There seems to be a preferred habitat selection in the sense of adaptive radiation among the Libyan tortoises (a special publication is being prepared), at least in the area around KNP. All habitats where *Testudo graeca terrestris* was found were south of El Beida or south of the watershed boundary and are reaching as far as Faydijah. All these habitats were of an open macchie with less vegetation density than in the area of the KNP.

2.1.3 **Caretta caretta (Linnaeus 1758)** (fig. 6, 7)

General Aspects

According to Armsby (1980) some first investigations on the loggerhead sea turtles were mentioned for the KNP. They were done in June and July 1980 and consisted in daily patrolling of the beach areas on foot or by boat while searching for any sea turtle activities like crawl tracks, nesting sites and others. Night patrols were carried out by him as well as by me and the data and information they collected on nesting sites are also included in this report.

According to Armsby's investigations and my own field observations in 1983, the nesting activity begins in the second week of June and extends into July. Armsby tagged one specimen (P23371) and estimated the percentage of predation of nests on the beach. On July 4, 1980 46 turtle nests along KNP's beaches were discovered. But unlike Armsby, I did not observe a two- or three-week cycle of nesting activity. Also I cannot confirm his observation on page 83 (op. ccit.): "Examination of the tracks around the disturbed nests reveals that herd dogs are the major offenders", as on our night excursions we saw only jackals predating on eggs, never dogs. During many beach excursions and night patrols we found several jackals disturbing nests and predating on eggs. I observed an abnormally high predation on both the eggs and adult females; but it must be supposed to occur at a high rate on the

hatchlings, too. Also men (soldiers and farmers) disturb the ecological stability of the turtles' population when they collect their eggs and probably also kill some specimens for their shells – I found specimens whose shell was cut off. The turtles themselves are not too heavily predated by man, mainly because the Islamic religion forbids the consumption of any kind of animal with claws. In addition, the turtles feed on molluscs, crustaceans and fish, which render their meat untasty.

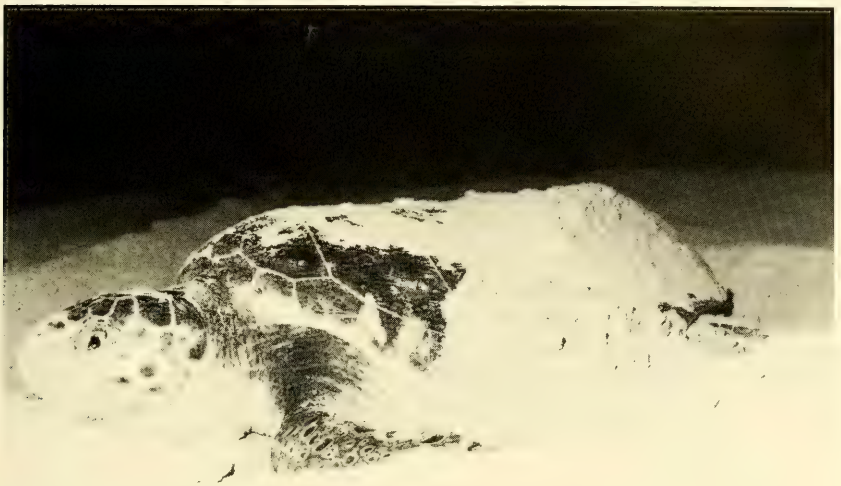


Fig. 6 *Caretta caretta* photographed about midnight on June 1983 during nesting activity.

Some Field Notes on Beach Patrols

05.31.83

First beach patrol for sea turtle nesting activity without success

06.18.83

5 nests, many crawls about 3 km west of Haniyah

06.18./19.83

- 22h00, 2 km west of Jarjaroma: sea turtle comes ashore; in this area 20 nests have already been predated and completely destroyed by jackals (see fig. 7)
- 21h30: freshly robbed nest with 30 predated eggs and 10 eggs left as we disturbed one jackal

06.23.83

- 4 dead Carettas on beaches 10 and 11, surrounded by many jackal tracks; turtles freshly opened by lateral neck bites, only for the benefit of predating on the turtle eggs out of the ovaries
- 18h00, 500–800 m west coast hill Wadi Jarjaroma: 1 dead Caretta; 20–50 m nesting distance from coast line in this area: high density of jackal tracks parallel to beach
- end of new road (south of Qasr Libya): high holiday and bathing activity of people using beaches 9 and 10 which probably become worthless as a nesting site due to the construction of this new road
- 6 km westward before rock hill: dead Caretta beside body and egg pit; crawl 25 m south of shore line: width: 75 cm, diameter of body pit: 1.2 m; specimen hollowed by lateral neck bites; many car tracks
- 7 km further west: heavily disturbed egg-laying site, wooden boards, rubbish; completely excavated body and empty egg pit; 20 m south of shore line, crawl width: 95 cm; nesting site seemed to be left from turtle after or during heavy attacks by jackals (due to their tracks) before the eggs had been laid
- 7.5 km further west: empty nest, V-shaped crawl 10 m south of coast line

- 8.1 km further west: V-shaped crawl, 13 m south of coast line, crawl width: 80 cm; 27 fragmented egg shells after jackal's predation, 23 eggs remained in egg pit; depth of body pit: 45 cm, depth of egg pit: 20 cm and diameter 16 cm
- 8.3 km further west: 2 Y-shaped crawls, one 17 m and the other 10 m, south of coast line, crawl width: 90 and 95 cm, no eggs
- 8.5 km further west: 2 robbed nests; first nest, 17 m south of shore, contained 50 eggs; second nest, 15 m south of shore (7 m west of first nest), contained 35 eggs; all eggs predated by birds and jackals according to their tracks
- 9.8 km further west: robbed nest 6 m south of shore line; skull, flippers and intestines on wave wash, shell is missing – probably killed by men
- 10.1 km further west: robbed nest, 20 egg shell fragments, crawl width: 64 cm, body pit: 75 cm deep
- 10.4 km further west: dead body of Caretta 17 m southeast of coast line, crawl width: 75 cm, shell surrounded by many jackal tracks, sand sunk in by digging of predators to a depth of about 1 m, completely hollowed
- east of Wadi Jarjaroma: 4 crawls on beach opposite to small islet 2 nests with 30 and 40 eggs completely predated

06.28.83

- night: Ghibbli, very hot and sand storm
- 5.6 km east of Wadi Jarjaroma: 30 m landwards crawl with approx. 35 cm deep body pit but without eggs (many typical jackal faeces with juniperus berries)
- 5.5 km east of Wadi Jarjaroma: 25 cm deep body pit about 26 m south of coast line, crawl width: 75 cm
- 5.3 km east of Wadi Jarjaroma: 26 m south of coast line, Y-shaped crawl with a width of 75 cm predation where 40 remaining egg shell fragments were counted (between beaches 5 and 6)

07.06.83

dead Caretta and 6 robbed nests in front of Wadi Buzangug

07.09.83

there were no further nesting activities to be seen but on a final patrol we found between Hanijah and Wadi Buzangug a further hollowed shell of a Caretta already lacking the horny shields (beach 12).

Material and Description

Specimens preserved: 5; KNP 1981.

Many observations were possible during the nesting season, of course most of them were due to tracks (crawls and nests) some on shells and some on living specimens. The specimens collected for the museum were taken from the beach after they had been killed by jackals.

One night, around two o'clock, whilst taking advantage of our first and best opportunity for detailed observations, we were arrested near a military camp, as we were regarded as being American spies. I would like to take this opportunity for thanking my colleague Lindon Cornwallis for his moral support and assistance during the time we shared whilst being chased with raised arms through the night, followed by a soldier with a loaded machine gun.

A general description for the loggerhead could be given as follows: quite dark brown carapace, sometimes with green or dark coloured blotches while the plastron is yellowish white and the flippers black.

There might be some hints of an own Mediterranean subspecies that could be smaller than the Atlantic forms but there are still too few observations for a diagnostic differentiation.

Nesting Biology and Predation

General Notes on the Nesting Biology of the Loggerhead Turtles

According to Hirth & Hollingworth (1975: 5), the sequences of nesting behaviour are as follows:

a) emergence from wave wash
b) crawl from surf to nest site
c) excavation of body pit
d) excavation of egg hole
e) oviposition
f) filling and pounding of egg well
g) crudely filling of body pit
h) crawl from nest site to surf
i) traverse of surf.

The nesting activity from arrival at the surf until return lasts about one to two and a half hours. The average size of the body pit was about 80 cm in diameter and about 50 cm deep, whereon the size of the egg pit follows with a width of 20–30 cm and a depth of about 20 cm. The average number of eggs laid was about 40 (minimum: 30; maximum: 50).

Detailed informations on the soil conditions during this time are shown in Chapter 3 on Ecology. These data were kindly submitted by Ing. Mahmud Yasin (KNP; Jordania) and demonstrate the soil conditions for the time of incubation concerning moisture content and temperature. YNTEMA & MROSOVSKY (1979) showed that for the incubation of *Caretta* eggs temperatures between 26° C and 34° C are necessary. With temperatures from 26° C to 28° C no females were among the hatchlings; at 30° C, 64% were females and from 32° C to 34° C, 100% were females.

Predation on Nests (eggs) and on Adult Females

ARMSBY (1980) regards herd dogs as the major predators for destroying the nests; jackals are also supposed to predate on the nests or on the hatchlings. In fact it could be shown that there were no dogs at all predating on the turtles or their nests, only jackals were seen on night excursions; many of their tracks (foot prints and fecal pellets) were also observed.

As far as is known there are no regulations concerning the taking of sea turtles or their eggs. Local people eat the eggs, mostly military people who are stationed in the park, get an easy chance. But the most destructive predation is caused by jackals of which we saw many during their nocturnal patrols along the beaches searching for turtles and nests. They destroy many of them by their way of digging or scratching for the eggs. But as often as possible they predate easily on a complete nest and in only one case some eggs remained – but in the thus worthless opened nest. A very ugly way of predating on the eggs and thus also with diminishing the adult female population, is by killing the landed females by biting and opening them on the side of their neck and pulling out the ovaries. All the rest of the flesh and other turtle material remained untouched by them. The rate of predation especially in the KNP area seems to be extremely high and it is frustrating for a scientist to work there for their protection or conservation. Even the park's directors are not able to help because of their political restrictions or were not able, for the turtles arrived during the religious month of Ramadan, when no human activity was possible! I found five turtles killed in this area alone and a predation on the nests of surely more than 90 %, while the predation on hatchlings and on juveniles in the sea are still unregarded.

Distribution in KNP (fig. 7)

The coastal area is composed of wide sandy beaches with some rocky outcrops or platforms and with some small rocky islets. During the winter season heavy rains and storms lead to flooding of the back beaches, so that the two Sebkahs Ayn Shagigah and Ayn as Zargah become flooded. With late spring time and during the summer period, warm climatic conditions with hot southern winds (Ghibblis) dry the beach areas.

The major nesting areas along the KNP and its vicinity are shown on the following map (fig. 7). Especially dense nesting activity was seen a few kilometer west of Haniyah and east of Wadi Jarjaroma. The density of the nesting activity during the two observation periods (1979/83) is demonstrated by different symbols on the map.

2.2 Sauria

2.2.1 **Chamaeleo chamaeleon chamaeleon (Linnaeus 1758)**

Material and Description

Preserved specimens:

- 3 KNP 1981/174, 175
  1983/428
- 12 ZSM 1983/114 Faydijah, 1983/115 KNP

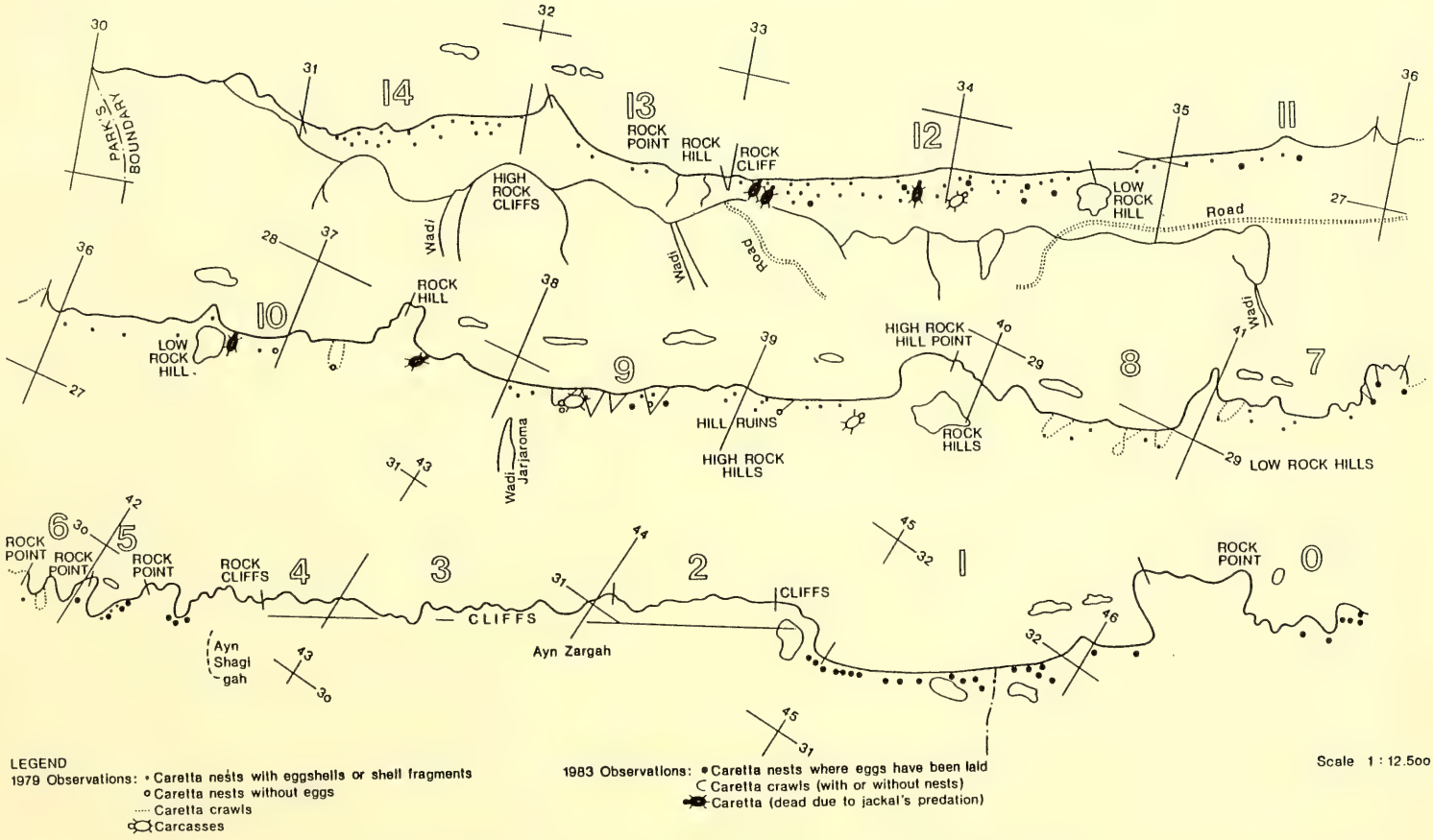


Fig. 7 Distribution of sea turtles activities at KNP and surrounding beach areas.

Most of the specimens preserved for the ZSM collection are due to road-killed material. Many specimens were observed in wildlife and also kept in captivity. The highest number of specimens (approximately 90 %) were found crossing the main road during July and August. A rather high number of road killed chamaeleons were seen mainly on the road between Qasr Maqdum and Qasr Libya. At least one killed specimen could be found there each day during these months.

According to HILLENIUS (1978) the Libyan chamaeleons belong to the subspecies *Chamaeleo chamaeleon chamaeleon*. The size of the common chamaeleon reaches up to 28.3 cm total length while their body reaches up to 16 cm in Libyan specimens (HILLENIUS, op. cit.). The biggest chamaeleon I found in Libya was from the area south of Faydijah with a total length of 26.1 cm. According to HILLENIUS (op. cit., p. 40, Fig. 2) it can be generalized that females usually have shorter tails than males. The sexual dimorphism might therefore be expressed as follows: the relative height of casque and the relative head length is smaller in females than in males. According to HILLENIUS (op. cit.) I regard the feature of the "saharicus crest" as a variation of the standard form, as there were some specimens with crest scales and some without. As for the "tarsal spur" mentioned by HILLENIUS (op. cit.), it could not be found in any specimen.

The following measurements (tab. 5) and characteristic features were registered according to HILLENIUS (op. cit.).

Tab. 5 Measurements and characteristic features of *Chamaeleo ch. chamaeleon* from KNP (according to HILLENIUS, 1978).

Location	BL	TL	HL	LM	CH	CW	CL	n-gc/vc	SC	LT
KNP	8.0	8.2	2.70	1.50	1.85	1.00	1.25		6	1
KNP	5.3	5.5	2.00	1.32	1.30	0.87	0.80	14	-	1
KNP	7.5	7.3	2.49	1.70	1.60	0.90	1.00	14		2
KNP	9.2	9.6	3.30	2.40	2.15	1.30	1.40	15	5	2
KNP	6.4	6.2	2.30	1.50	1.50	1.05	1.41	13	6*	-
KNP	9.8	10.2	3.50	2.50	2.31	1.45	1.00	18	-	2
KNP	9.5	9.1	2.90	2.03	1.75	1.20	1.82	18	2**	2
KNP	10.5	11.0	3.40	2.25	2.30	1.40	1.68	18	-	2
KNP	7.0	7.6	2.35	1.60	1.56	0.98	1.05	15	-	2
Faydijah	13.0	13.1	4.90	3.40	3.15	2.25	2.40	20(23)	6	2

* 4 after pin. foram. ** before pin. foram.

BL	Body Length	TL	Tail Length
LM	Length of Mouth Opening	HL	Head Length
CH	Casque Height	CW	Casque Width
CL	Crest Length		
n-gc/vc	Number of Gular/Ventral Crest Scales		
SC	Saharicus Crest present or absent (with enlarged scales)		
LT	Lateral Stripes		

Tab. 6 List of food items taken from chamaeleons from different localities according to analyses of their fecal pellets (kindly submitted by Dr. Burmeister, ZSM).

Specimen No			Frequency
From KNP			
1	only plant detritus, flowers, buds (Rosaceae), plant tissues, seeds, flowers with seeds		
2 & 3	Heteroptera	Lygaeidae	rare
	Coleoptera	Curculionidae (big)	many
		Scarabaeidae	few
		Chrysomelidae (big)	few
		div. spp.	few
	Saltatoria	Ensifera (big)	one
	Hymenoptera	Apidae	few
		Sphecidae	few
		Formicidae	frequent
	Homoptera	small cicadas	frequent
	plant tissues		few
	Diptera	Calliphoridae, Tachinidae	some
	Solifugae	Solpugidae	one
4	Coleoptera	Curculionidae	many
		Cerambycidae	few
	Hymenoptera	Sphecidae, Psammocharidae	frequent
		Apidae	frequent
		Formicidae	rare
	Saltatoria	Ensifera	one
		Coelifera	one
	Heteroptera	Tingidae	two
		Lygaeidae	rare
	Homoptera	small cicadas	frequent
	Diptera	Tachinidae	few
	plant tissues		few
From South of Tobruk			
1 & 2	Hymenoptera	Formicidae, Apidae	few
		Sphecidae, Psammocharidae	many
	Heteroptera	Pentatomidae	many
		Cydnidae	few
	Homoptera	Auchenorrhyncha	few
	Coleoptera	Scarabaeidae (small)	one
		Curculionidae (small)	one
		div. spp.	frequent
	Diptera	Calliphoridae, Tachinidae	few
	plant detritus	seeds	many
		tissues	few

Biology

The chamaeleon seems to be one of the best adapted lizard species in Jebel Akhdar which is not only due to its ability of camouflaging and its specialized way of prey catching, but also to its ability to use the most different ecological niches. It can be found from desert areas up to mountainous woodlands (860 m high in Jebel Akhdar) where it is best able to climb shrubs and trees by using special climbing adaptations (see SCHLEICH & KÄSTLE, 1979). Its preys consist of flies and other insects, small lizards and leaves. The analyses of its fecal pellets provide varied information on this subject. Thus a detailed list of the food items taken by chamaeleons can be given here (tab. 6).

I wish to thank Dr. E.-G. Burmeister (Zool. State Collection, Munich) for his kind assistance in analyzing the fecal pellets of 6 different specimens. Those collected from a fully desert habitat, 71 km south of Tobruk, are also included here for general comparative information.

According to BELLAIRS (1969/71: 676–677) the egg laying period is during autumn, in October, and the hatchlings appear in August of the following year. I found the first small chamaeleons with minimal lengths of about 6 cm (including tail) in KNP during July and August. For the life habits of the chamaeleons in North Africa SCHIFTER (1980: 232) mentioned that the Common Chamaeleon in North Africa seems to be chiefly terrestrial and less arboreal which is true for all those I saw in Libya. He further mentions that they are housing in self-burrowed holes in the soil. Brief field notes on a chamaeleon I found close to the park's sea shore will supply more information on this subject:

On 10 June, at 11h00, a female chamaeleon was found at 15 m above sea level on a sun exposed limestone hill in the sandy coastal area, after leaving its approximately 30 cm deep hole. Its size was 9.5 cm body length and 10 cm tail length. On being discovered, it first tried to hide under a spiny Sarcopoterium bush. First it was dark coloured, with two white stripes, and when it tried to escape to a nearby bigger, green Pistacia shrub, its colour changed completely to green after half-way (1 m) within 5 seconds. Its aposematic reactions consisted in biting, inflating of its gular pouch and body wagging.

The measured temperature records were:
- body temperature: 33.5° C
- soil temperature: 48.8° C
- air temperature (windy): 23.6° C
- soil humidity: 55.3 %
- air humidity: 53.4 %
- hole temperature in a depth of about 30 cm: 22.1° C.

} all data sun exposed

From the chamaeleons kept in captivity at KNP's campsite one served for temperature measurements with a fixed thermistor. Unfortunately it escaped in the early afternoon of the data recording day (July 1983), but there are still some interesting values that I measured. In fact there is a close relation presented between soil surface temperature and body temperature for the time of basking and warming up (see tab. 7).

There were different behaviour patterns to observe in approached (threatened) specimens, like: colour changing, body wagging from leg to leg, crest erecting, camouflaging by colour, body shape variation and locomotion, running, spitting and biting.

As HILLENIUS (1978) stated, chamaeleons originated in East Africa and spread from there while its descendants may now have reached the Mediterranean, emigrating along the Nile and from there spreading to the north, west and east. But new fossil records for this genus, recently described by SCHLEICH (1983, 1984) with miocene species from South Germany give new information on the fossil history. Therefore the origin and in particular the ideas about evolutionary migration or distribution still remain to be discussed for this genus.

Tab. 7 Body temperatures and corresponding soil temperatures of a captive, free moving chamaeleon.

Time	Body Temperature °C	Soil Temperature °C(± 0.5°C)
07h00	13.9	15.4
07h30	16.8	17.5
08h00	25.8	24.9
10h00	29.7	27.5
11h00	33.8	33.4
12h00	30.5	29.2
13h00	32.1	30.2
14h00	escaped	

Distribution in KNP (map 3)

Chamaeleons were found at the following locations:

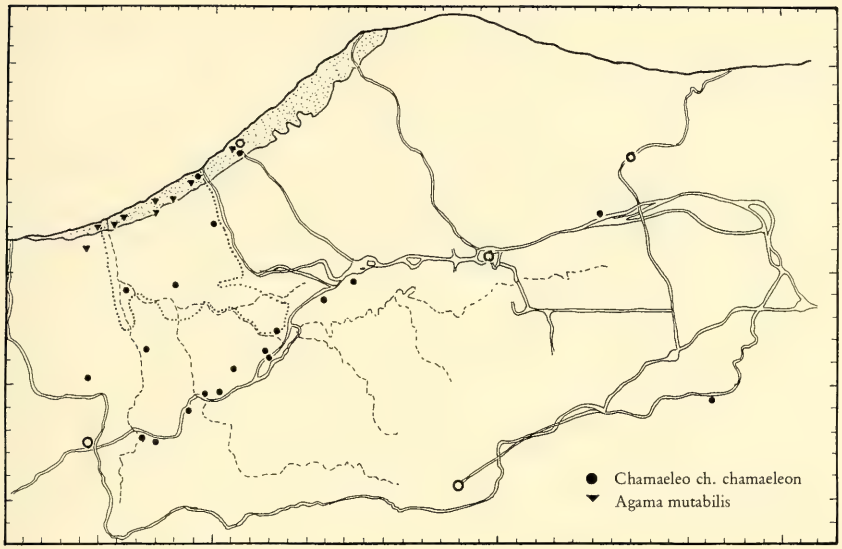
Date	Time	Place
10. 5. 83		Beach
14. 5. 83		Wadi Kouf
31. 5. 83	12h00	Road to Qasr Libya, juvenile specimen
		(At this and the following location many chamaeleons were found during July and August but only two will be listed here.)
19. 6. 83	10h30	Road to Qasr Maqdum, juvenile specimen
10. 6. 83		Road to Qasr Maqdum, killed
		(Especially in this range a large number of road-killed specimens was to be seen.)
21. 6. 83		Caught at Bartamedo, at a height of 1.5 m in a Juniperus bush
25. 6. 83	11h00	Road to Shahat, juvenile specimen
26. 6. 83	12h00	Wadi Jarjaroma, juvenile specimen
6. 7. 83		Road between Qasr Libya and Qasr Maqdum, killed
30. 7. 83	9h30	KNP's family houses, male
	9h30	Road to Kouf, male
	10h00	Road to Massah, male killed
		(Before this time no obvious males were found)
	10h00	KNP's entrance road, male

2.2.2 **Agama mutabilis Merrem 1820**

Material and Description

Preserved specimens:
- 3 KNP 1981/330, 358
  1983/519
- 6 ZSM 1983/139, 140, 141, 142 (collected outside KNP)

Many specimens were observed in the close beach area in KNP (see map 3), while others were collected and observed on different field trips in Libya. Further ones were kept under semi-natural conditions for some months at the KNP's campsite for observation.



Map 3 Observation and collecting sites around KNP for *Chamaeleo ch. chamaeleon* and *Agama mutabilis.*

These desert agamids reach a total length of 17–20 cm. Their colouring is quite cryptic while the males show attractive blue lateroventral colours. The dorsal colour pattern consists of five brown bars, the first of which crosses the neck and the fifth lies at the height of the cloaca. These bars are dark reddish brown with brighter central spots, the general colouring is pale brown or greyish. The gular part shows dark striped or reticulate lines comparable to those of other agamids, too (see e. g. HARRIS, 1964 and SCHLEICH, 1979). The squamation shows typical irregularly enlarged dorsal and lateral keeled scales. The eyelids are well developed, the outer ear openings are visible and surrounded by two or three spiny scales. The slightly enlarged brain shield is in direct contact with the frontal. In most cases 17 supra- and 20 sublabials are present.

The following measurements (in cm; see tab. 8) were taken of two adult specimens (one male and one female):

Tab. 8 Metric proportions of one couple of adult *Agama mutabilis.*

Sex	Body Length	Tail Length	Head Length	Head Width
Male	8.8	9.7	2.2	2.15
Female	6.8	8.4	1.9	1.8

Biology

No hatchlings or juveniles were seen during my working period at KNP. – Mostly when an *Agama* was to be seen there, one male together with one or two females could be recorded. The males showed their characteristic blue flanks and throat colouring mainly during the supposed mating period between May and mid-June. Most of the specimens found later did not show these characteristic features. The females found during June had well developed eggs; one specimen laid its eggs in captivity at KNP.

One specimen collected on 11 June 1983 at Haniyah contained six well developed eggs, another pregnant one was found at Quubba at the same time.

The measurements (tab. 9) of the oval-shaped soft-shelled eggs were:

Tab. 9 Egg measurements from fresh laid clutches of *Agama mutabilis*.

Length (in cm)	Width (in cm)	Weight (in g)
1.80	1.10	1.20
1.90	1.12	1.05
1.71	1.15	1.10
1.90	1.10	1.00
1.95	1.10	1.00
1.85	1.10	1.00
1.80	1.05	1.00
1.77	1.05	0.90
1.70	1.00	0.90

Further data of interest for the biology and thermoregulation of *Agama mutabilis* include some temperature records taken from basking specimens which I collected on the main road between Marsa Bregah and Ajdabia on 8 May under full sun exposure. Lying flat on the hot asphalt surface of 30.4°C the related body temperatures were: at 09h50: 32.4°C, at 10h00: 33.4°C and at 10h15: 35.8°C. After this time no more basking took place on the road, for the animals had reached their preferred temperatures. The specimens kept in captivity at the KNP's camp area seldom reached their adequate activity temperatures at this altitude of about 700 m. Only rarely did they come out of their hiding places. Further temperature readings were made on 26 June, 11h45, when they were first active after basking. The soil-surface temperature was 32.2°C and the body temperature 31.3°C. When the area became shaded at 17h00 they were still active outside with a body temperature of 27.6°C.

Dr. E.-G. Burmeister (Zool. State Collection, Munich) kindly examined the gut content of one specimen caught at Suluntah. The analysis of the dried fecal pellets yielded the following food items:

Hymenoptera – Formicidae	quite frequent
Coleoptera – Curculionidae	rare
Saltatoria – Caelifera (Acrididae)	rare
Herbal detritus (plants)	very few

Predators: As there seemed to be one evident record for a certain predator on these agamids I will mention it particularly. Of course there are many others which are generally mentioned in Chapter 3. On 10 June 1983 I found on a sand dune at Sebkah Ayn al Zargah, partially covered with vegetation of Limoniastrum monopetalum, one nearly dead attacked *Agama* that was surrounded by fresh jackal tracks.

Distribution in KNP (map 3)

All specimens observed were found at the beach near hills or rocks or inland up to a distance of about 2–3 km south of the coast. For the KNP this area represents the range with the lowest rainfall (less than 250 mm/year) and also shows the most desert habitat conditions. The occurence of this species in this area of KNP migth be explained by penetration from the eastern and western desert ranges along the costal range of Jebel Akhdar. The first agamids that I found south of KNP were collected from localities about 50 km south of Suluntah and about 10 km north of Mekhili. According to Resetar (1981) no

further observations were made on the distribution of this species apart from two specimens in late autumn which he found hidden close to the beach.

2.2.3 Tarentola mauritanica (Linnaeus 1758)

Material and Description

Collected specimens:

- 46 KNP 1981/140–143, 148, 150, 151, 153–156, 168, 171, 177, 224, 224, 226–228, 233, 239–241, 244, 245, 258, 259, 268, 276, 284, 288, 289, 293, 304, 314, 328, 337, 345, 346, 359, 408, 412, 436, 442, 459, 460, 462, 486, 493, 500, 504
- 8 ZSM 1983/121

Most of the Tarentolas were observed at night on the camp's houses and also in the field during the day, especially on or underneath rocks and trees.

The Moorish gecko is greyish on top with four to five dark stripes on its back. Twelve dorsal tubercular rows can be counted with a mid-dorsal row that shows the smallest keeled scales of all. The scales of the three following rows are strongly keeled and mostly surrounded by single scales while the following lateral ones consist of spiny keeled scales surrounded by two at the third and two to three at the fourth and up to seven smaller scales at the lowest lateral scales. Eight supra- and seven sublabials are present. Up to 13 subdigital lamellae can be found underneath the third digit. The mouth opening reaches slightly behind the eye slit. The tail's scale rows consist of six single tubercular scales on each segment. The ultrastructure of a *Tarentola* toe surface is shown in Schleich and Kästle (1986).

The vocal sounds which are produced are a (roaring and squeaking) sound rather similar to the sounds described for the Giant Cape Verde Gecko (Schleich, 1980).

Biology

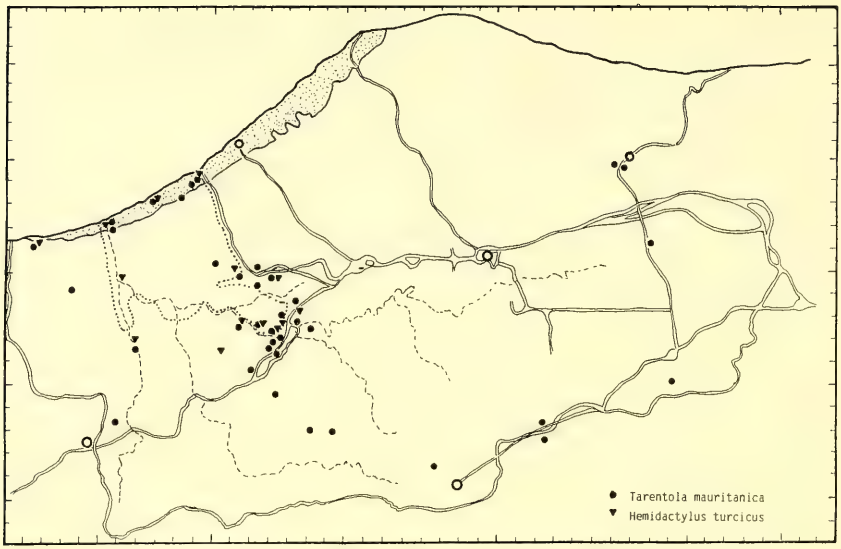
Tarentola mauritanica is mainly a nocturnal creature but can also be seen active during daytime. These geckos feed on insects and lay one to two hard-shelled, globular eggs which are mainly attached to hard ground. On 18 July 1983, an adolescent *Tarentola* was observed feeding a solpugid of a size much bigger than its own head. Half-grown specimens were first seen in June, juveniles in May, therefore it may be supposed that they hatched in April this year.

On 23 July 1983, at 22h15, the following temperatures could be recorded: the air temperature measured 18.3°C and the surface temperature of the gecko's wall was 19.7°C; the corresponding body temperature of one adult was 19.4°C and of two juveniles 22.8°C and 20.6°C. These body temperatures were in fact rather low, therefore only very few specimens came out of their hiding places whereas they normally appeared at about 21h00 and withdrew into their refuges between 04h00 and 05h00 a. m. Further registered temperature records on 13/14 May 1983 (measurements taken between 24h00 and 02h30): air temperature: 16°C, surface temperature of wall: 16°C, body temperatures: 19,19,19°C.

Distribution in KNP (map 4)

I recorded *Tarentola mauritanica* between Dernah and Marsa Bregah, specimens from Tripolitania were seen at the Tripoli National History Museum's collections. In KNP they were found from Shahat to the west boundary and from the coastline to the south boundary.

While the forms in the northern ranges of their distribution were greyish coloured, the southern ones seemed to be more brownish. *Tarentola* was found in the Jebel Akhdar area at all elevations from zero to the highest point of 860 m and therefore in all climatological and vegetational conditions. *Tarentola* was not only found close to settlements but also living in trees.



Map 4 Observation and collecting sites around KNP for Geckos *(Tarentola mauritanica, Hemidactylus turcicus)*.

2.2.4 **Hemidactylus turcicus (Linnaeus 1758)**

Material and Description

Collected specimens:
– 20 KNP 1981/152, 225, 233, 236, 269, 278, 285, 327, 336, 355, 360, 361, 417–420, 434, 451, 452, 505, 512
– 1 KNP 1983/123

While I found only a few Turkish Geckos, RESETAR (1981: 12) reported them in 22 locations. The majority I recorded in summer and spring in Kouf, were from the campsite's houses. A few of them were found also on some night excursions in rocky areas. The Turkish Gecko reaches a size of about 16 cm total length. Typical for its easy identification are its separated sub-digital lamellae, plus scaling and colour. The specimens showed 14 rows of granulated scales on their backs and flanks. The basic colouring was pinky grey, or slightly brownish with bright scale granules and dark spots on its back. There are about 10 dark annuli on the tail and granulated scales on each tail segment.

Biology

Unlike the Moorish Gecko which was also often seen active during daytime, the Turkish Gecko *(Hemidactylus turcicus)* seems to be exclusively nocturnal. According to RESETAR (1981: 12), they were mostly found underneath rocks or any other coverings. On 27 July 1983, I also found them under stones and together with equally sized juvenile Tarentolas at the family houses of KNP's campsite. They were mostly found during cooler nights when only juvenile Tarentolas and none of the adult Moorish Geckos were to be recorded. Thus one might assume that their preferred or activity temperature is somewhat lower than that of Tarentolas. I observed the same characteristics also during winters in southern Spain and also at Cabo Verde where *Hemidactylus* but no *Tarentola* were moving outside during colder nights.

Distribution in KNP (map 4)

Hemidactylus turcicus is also present at KNP, but not as common as *Tarentola mauritanica*. Few specimens could be found under stones in the park's area and its vicinity. None was seen to be arboreal and only a few were found on walls which might be due to the competition with *Tarentola mauritanica*.

Other specimens were found at following conditions:

- 15.5.83 rainy day under a stone in forest area
- 17.5.83 at 23h00 on night excursion to old road of Wadi Kouf, sitting on smooth rocky outcrop.

2.2.5 Ophisops elegans Ménétries 1832

Material and Description

Collected specimens:

- 77 KNP 1981/145–147, 157–167, 176, 178–183, 185–191, 193, 197–199, 201–203, 206, 217–222, 229–231, 234, 235, 238, 243, 254, 256, 274–275, 287, 294, 296, 297, 302, 303, 319, 323, 326, 356, 413, 415, 421–423, 439–441, 445–448, 455, 467, 484, 485, 487
- 5 ZSM 1983/128

Ophisops elegans reaches a total length of 19 cm with a body length of approximately 6 cm. The transparent palpebral disc on the lower part of its eyelids is a typical feature of this lizard. Its body is typically lacertiform. The dorsal scales on the neck's surface are very small and granular, the posterior ones are strongly keeled. The supra-oculars are separated from the superciliaries by a series of small granules. The lizard's dorsal colouring is dark and marginated by brighter dots with dark spots.

Biology

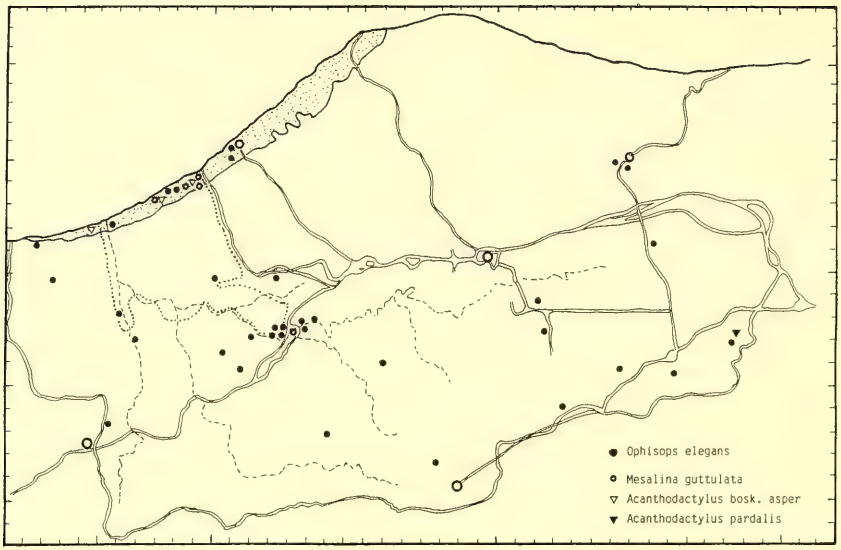
Ophisops elegans occurs in almost all areas of the KNP except the coastal sand plains, and also shows the widest temperature ranges for its activity. These were lower than for other lizards like *Acanthodactylus* or *Mesalina* but reached their higher values, too. *Ophisops* was still found active on 21 June 1983 at 20h00 at dusk at the campsite. On 10 June, at 11h15, I measured its body temperature as 29.5°C which corresponded to the same soil surface temperature on a limestone slope at the sea shore at Sebkah Ayn Zargah.

Three recently hatched *Ophisops* were found on 28 July 1983. Their recorded lengths were:

Body Length	Tail Length
2.2 cm	4.2 cm
2.1 cm	4.0 cm
2.0 cm	–

Distribution in KNP (map 5)

Resetar (1981: 15) stated that "the snake eyed lizard is by far the most commonly encountered lizard, being found in all areas of the park except areas of sand near the coast". He goes on to mention that (op. cit.): "In areas of terra rossa soil, *Ophisops elegans* has few competitors and can be found in grazed areas, bare plowed fields and areas of maquis." The following statements must be regarded as unproven (op. cit.): "*Chamaeleo chamaeleon* is an arboreal species...", also his opinion that *Chalcides ocellatus* "preferred shady areas beneath oaks as opposed to the rather more open situations preferred by *Ophisops*". In fact, *Chalcides* was found mostly in the same habitats as *Ophisops*, together with *Mabuya vittata* (see 2.2.10) and *Tarentola mauritanica* (see 2.2.3). *Chalcides* on the other hand was often seen in desert habitats all over Libya and the chameleon's terrestrial habitat occupation was quite obvious. But to be proved is that *Ophisops* is one of the most common reptiles in the Jebel Akhdar re-



Map 5 Observations and collecting sites of lizards *(Ophisops elegans, Mesalina guttulata, Acanthodactylus boskianus asper* and *Acanthodactylus pardalis)* around KNP.

gions, inhabiting nearly all ranges from the coastal areas to the open shrubs lands in the southern watershed range.

2.2.6 **Acanthodactylus boskianus asper (Audouin 1829)**

Material and Description

Collected specimens:

– 32 KNP 1981/149, 204, 277, 292, 298, 299, 305–308, 311, 318, 324, 329, 339–341, 343, 344, 347–349, 353, 357, 394, 396, 397, 406, 409

Acanthodactylus boskianus asper has a typically lacertiform body. Its dorsal scales are large and overlapping at the back but small and granular at the front. The fingers show three rows of scales around them. The gular collar shows enlarged scales ventrally. The colouring of this lizard is greyish brown with dark retiform patterns. The thighs are cream coloured and dotted and the colouring of the belly is greyish white.

A detailed description of the genus *Acanthodactylus* is given by Salvador (1982).

Biology

Resetar (1981: 17) mentioned a specimen that climbed "up six inches into a bush to grab a large grasshopper". He described the shape of their burrows in the sand dunes close to the beach as "flat on the bottom and rounded on top". With their spiny comblike scales on their digits, they are best adapted for a life in sandy areas like on dunes or beaches. Interesting in the behaviour of the Acanthodactyli were their slow tail waggings after every change of site or short run in their territories while the lower bright red tail surface is clearly exposed in the subadults and males as serving for their territorial behaviour. I also observed head nodding. It might be assumed that the young hatch in late autumn to have the advantage of fewer predators during the winter time, as I observed (unpublished) for *Acanthodactylus erythrurus* and other species in southern Spain.

On 5 June, 1983, at 12h45, I measured a body temperature of 32.8° C during sun exposure, while the soil temperature was 62.6° C and the shaded air temperature 27.6° C!

Distribution in KNP (map 5)

Acanthodactylus boskianus asper seems to occur from the Cyrenaika to Egypt. I got further records for this species from private collections at Ras Latin (Caliche Bomba). In the KNP they were only found close to the beach area. Resetar (1981: 17) recorded them in the dunes on beaches Nos 5 and 6. After all these observations it might be concluded that *Acanthodactylus* is exclusively found in the coastal areas of the Park.

2.2.7 **Acanthodactylus pardalis (Lichtenstein 1823)**

Material and Description

Collected specimens:
– 2 KNP 1983/513 (a-male, b-female)

I collected this species for the first time for KNP (outside watershed boundary) and it is represented by one male and one female specimen in the park's collection.

The basic colouring of this species is reddish brown and shows four yellowish spotted rows of dotted lines, beginning behind the pileus and ending at the height of the cloaca. Beside or between these rows black bars or intermittent rows of dots are typical. The ventral side is white with a slight greenish blue stripe and shows 12 enlarged rows of squamae.

The sexual dimorphism is demonstrated in a somewhat longer tail and less intensive colouring in the males but also in 23 enlarged femoral tubercles which do not show the secernent character in females. The males also show a row of enlarged post-cloacal scales and a broadened anterior part of the tail. The recorded lengths of both specimens were:

Sex	Body Length	Tail Length
male	6.2 cm	10.4 cm
female	6.5 cm	9.0 cm

Biology

Conclusions as to the biology of this species can only be made according to its distribution and habitat preferences, recorded on different field trips. *Acanthodactylus pardalis* prefers open dry lands that mostly resemble steppe habitats or were in fact Artemisia steppes. *Acanthodactylus pardalis* never occurred in such completely desert areas where *Acanthodactylus boskianus* was found.

Distribution in KNP (map 5)

These two specimens are the first record in the southern range of the KNP's watershed area between Gaygab and Faydijah. Other species seen in this habitat were *Ophisops, Malpolon* and *Chamaeleo.*

2.2.8 **Mesalina guttulata guttulata (Lichtenstein 1823)**

Material and Description

Collected specimens:
– 33 KNP 1981/169, 170, 270, 279, 280, 295, 300, 309, 310, 315, 320, 322, 325, 331, 332, 334, 342, 350–352, 395, 402, 403, 468–474
– 1 ZSM 1983/129

Mesalina guttulata guttulata is probably the smallest lizard in the park besides *Ophisops* and *Hemidactylus*. It shows a lacertiform habitus with its nasals in broad contact behind the rostrals and the frontals in contact with the supra-oculars. Their colouring is greyish with dorsal stripes and dark patches.

Biology

Not many details on the biology of *Mesalina guttulata guttulata* are known. Resetar (1981: 18) reported a specimen that climbed into a small bush to rest on its outer branches "eight inches above the ground for a few minutes".

Distribution in KNP (map 5)

Mesalina guttulata guttulata is found mostly in the close beach areas. One specimen was seen at the big limestone quarry on the old road. The sun exposed southern steep slope with utmost warm microclimatic conditions might be expected to be the reason for such a delimited habitat selection.

2.2.9 **Chalcides ocellatus (Forskål 1775)**

Material and Description

Collected specimens:
- 21 KNP 1981/172, 173, 194, 195, 242, 255, 257, 286, 362, 365, 405, 411, 424–427, 433–444, 454, 481, 491, 495, 499
- 5 ZSM 1983/125

Besides these listed museum specimens many live ones were observed and mapped. Some of them were kept in captivity for several months at the KNP's campsite.

The ocellated or eyed skink reaches a total length of about 26 cm. Its body is of cylindrical shape, the head slightly sphenoform. The legs are short. The ear opening is about the same size or smaller than the orbit. Their middorsal colouring is brownish or greyish with two dark dotted lateral stripes beginning behind the eye and running to the hind limbs. Dorso-medial runs a broad dark dotted stripe from the head to the insertion of the hindlimbs, consisting of dark scales with bright small medio-longitudinal stripes. On the tail, every third scale row shows a dark annulus of those marked scales. The belly is pale.

Biology

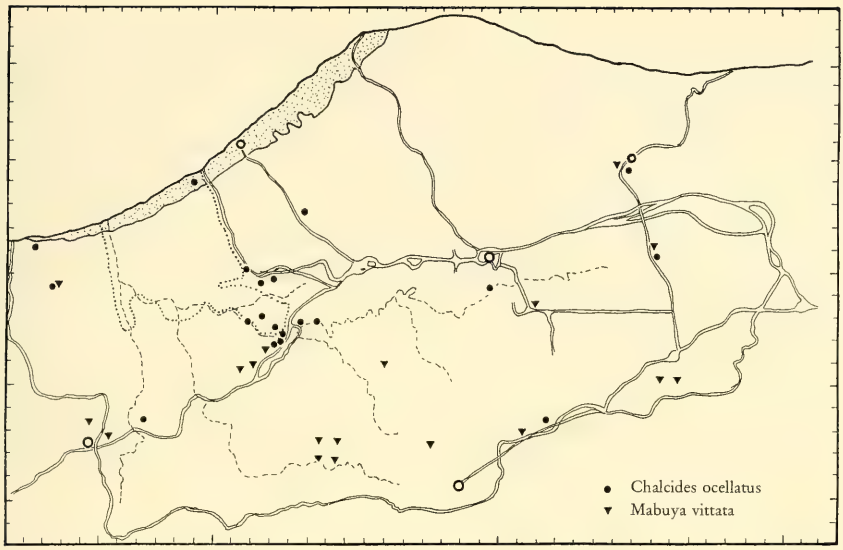
I found *Chalcides* in Libya from the mountainous areas of Jebel Akhdar to the steppes at the Sirte Basin and east to Tobruk in carstic regions. They varied in their colouring between reddish brown and greyish forms. The biggest specimen I found in Libya was seen at El Marj at a waste water pond and had a similar size to an adult *Eumeces*. They were observed to be very aggressive in captivity.

On 26 June a body temperature of 31.8° C was taken at 13h00 for a basking specimen, but they were still observed to be active outside their hiding places at 17h00 and later, until dusk. During June and July I observed them outside their hiding places even during the hottest hours of the day.

The main prey item in a study population of Bons (1959: 95) in Morocco consisted of crickets but that may be easily explained by the preferences of the micro-habitats of this lizard.

Distribution in KNP (map 6)

I found *Chalcides ocellatus* to be widespread at least all over northern Libya but it was also found in KNP in nearly all areas beside the beaches. Preferred habitats were macchias or forests but they also occurred in open landscapes with a complete lack of vegetation. They mostly occurred in the same areas together with *Ophisops, Mabuya, Tarentola* and *Testudo*.



Map 6 Observation and collecting sites of skinks *(Chalcides ocellatus, Mabuya vittata)* around KNP.

2.2.10 **Mabuya vittata (Olivier 1804)** (fig. 8)

Material and Description

Collected specimens:
- KNP 1981/...
- 5 ZSM 1983/126, 127

In spite of the fact that *Mabuya vittata* seems to be one of the most abundant species in the KNP area, there was nothing mentioned about this scincid lizard by RESETAR (1981).

Three specimens are preserved in the Kouf's collection. One pregnant female gave birth to three young on 18 June 1983, while in captivity. The habitus of *Mabuya vittata* is somewhat lacertiform and its proportions of one female and the newborns are shown below:

Body Length	Tail Length	Weight
3.1 cm	6.5 cm	1.0 g
2.4 cm	7.4 cm	1.0 g
2.9 cm	7.3 cm	1.0 g
8.0 cm	reg.	10.6 g female, after birth

Mabuya vittata shows a transparent palpebral disc in the lower eyelid. The dorsal colouring is brownish with a cream or whitish coloured belly. Different dark line patterns may occur and are shown on the drawings for the colouring of the above-mentioned young (fig. 8).

Fig. 8 Colour pattern of a *Mabuya vittata* female (right) and two of its young (left).

Biology

The capture of a pregnant *Mabuya vittata* on 16 June 1983 at Cyrene archeological site was very interesting. The female was kept in captivity to allow observation of the clutch. After two days three young were born alive while one was already dead at birth. All of them weighed about 1 g; their lengths are listed above. The colour distribution among the newborn scincs was also interesting. Two specimens were unicoloured with dark/bright/dark lateral stripes, the third specimen showed two dorsal rows of dots intermittent with bright coloured dorso-lateral stripes. On 15 July several recently born Mabuyas were seen at Massah. They had already reached half of the size (total length) of adult specimens. Thus, according to these observations, mid-June can be regarded as the reproductive period for *Mabuya vittata,* at least for the KNP area.

I also registered some temperature records for *Mabuya vittata.* Under semi-natural conditions they were taken in captivity on 26 June 1983 (tab. 10).

Tab. 10 Temperature and activity conditions of a free moving *Mabuya vittata* specimen from 26. June 1983, kept at KNP.

Time	Body Temperature	Soil Temperature	Activity
07h50	20.9°C		
08h00	31.7°C	30.6°C	crawling out of sandy soil, basking with half exposed body, still remaining in ground, setting of feaces
08h15	34.4°C		
09h45	34.5°C		
10h25			
13h30	29.3°C		
15h00			semi-active (shadow)

Distribution in KNP (map 6)

The Bridled Skink, *Mabuya vittata,* is distributed widely from North Africa to southwest Asia. It is the most common scincid lizard apart from *Chalcides ocellatus,* especially in the Jebel Akhdar region. The preferred habitats of this skink seem to be the dense macchia vegetation, margins of agricultural areas and shrub lands. *Mabuya vittata* was neither seen in the beach range area, regarded as (para-)desertic, nor in the south of the watershed to the open steppe land. Dense populations together with *Ophisops* were found west of Omar al Mukhtar where the species reaches its highest elevation for its distribution in Jebel Akhdar. It may be stated that *Mabuya vittata* belongs to the most common lizards in the Park area with a rather wide distribution there.

2.3 Serpentes

2.3.1 Eryx jaculus (Linnaeus 1758)

Material and Description

Preserved specimens:
– 2 KNP 1981/...

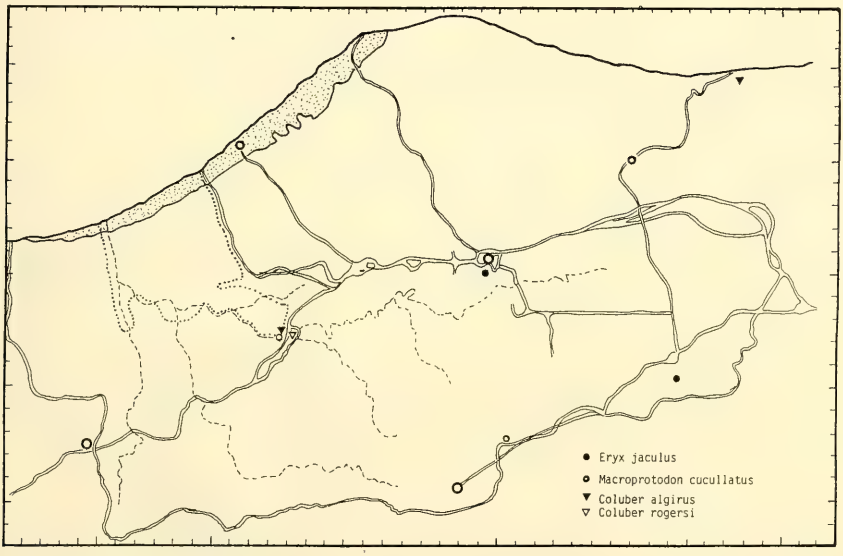
The maximum known length for *Eryx jaculus* is recorded with at 80 cm while most of the specimens reach a length of between 30 and 60 cm. The head of this snake gradually merges into neck and body. The dorsal scaling is smooth, rhomboedric and not overlapping. Its upper jaw is longer than the lower one. The anterior snout shield is well developed functionally for the soil-burrowing life of this snake. Its dorsal and lateral colouring is greyish brown with dark brown spots. Dark stripes are shown between the eyes and snout angles. Its ventral colouring is greyish white.

Biology

The sand boa spends most of the daytime hiding underneath stones, whereas it is more active outside at dawn and dusk. According to Trutnau (1981, I: 79) mating time takes place in April or May. 5 to 12, sometimes up to 15, young are born alive. The snake preys on lizards and mice by constriction.

Distribution in KNP (map 7)

For the KNP watershed area *Eryx jaculus* was only recorded twice by Herbert in 1979 from El Beida and 8 km southeast of El Faydijah (20 km east of Beida) on 20 July 1979.



Map 7 Observation and collecting sites of *Eryx jaculus, Coluber algirus, C. rogersi, Macroprotodon cucullatus* around KNP.

2.3.2 Coluber algirus (Jan 1863)

Material and Description

Preserved specimens:
– 4 KNP 1981/272, 311, 354, 509

The head is typically colubrid in its habitus being clearly differentiated from neck and body. The dorsal scales are imbricate and rather weakly keeled. The great anal shield is undivided. The colouring is greyish with black bars along the back. Laterally the dark blotches are in alternated arrangement to the dorsal bars. The belly is a palish grey without markings.

The following metric and lepidologic features characterize the KNP Museum's specimens (tab. 11).

Tab. 11 Sizes and lepidological features of *Coluber algirus* from KNP's museum specimens.

No.	Body Length (cm)	Tail Length (cm)	n-ventrals	n-dorsals	n-sublab.	n-supralab.	n-subcaud.
3666	27.0	8.3	257	24	10	9	95
3722	77.0	23.0	216	25	10	9	
-	67.0	23.0	214	23	9	9	

Biology and Distribution in KNP (map 7)

Not much information is available on the biology of *Coluber algirus*, and not many specimens are recorded. It seems therefore difficult to describe their distribution or habitat selection. The one record from the northwestern corner of the park is only a possible one, because the specimen was neither seen well nor caught.

2.3.3 **Coluber rogersi (Anderson 1893)** (fig. 9)

Material and Description

Collected specimens:
– 1 ZSM 1983/151

I caught this specimen after receiving helpful information from Mr. Abu Haidar from the staff houses at KNP in the first week of August 1983. The specimen tried to hide under the spare parts of Abu

Fig. 9 *Coluber rogersi* from KNP.

Haidar's repair shop. With the kind support of Mr. Abd el Salam I brought this specimen for observation purposes to the Zoological State Collection at Munich.

The colouring of this specimen is dark brown with yellow dorsal stripes and lateral rhombs. The exposed pattern is typically colubrid. Every second or third ventral shield shows lateral brown spots that can still be present on the margin of the following shield. The dorsal scales show reddish brown, thin medio-longitudinal stripes. Two hundred and twenty-seven ventrals, 80 subcaudals and 25 caudals are present. There occur 10 supra- and also 10 sublabials. The nostrils are divided. The seventh to tenth supra- and the sixth sublabials are enlarged. The supracaudals are divided, the anal shield is undivided.

Biology

I saw and caught just one specimen at about 20h00 when it was moving slowly and hiding among spare parts in the repair shop. The close habitat where it is supposed to come from consisted of dense macchia shrubs and forests between Kouf and El Beida where a carstic limestone area with loamy soil is exposed. The specimen is much less aggressive and preys in captivity on geckos, lizards and mice. On 20 August 1983, in captivity at Kouf, the specimen laid four very long-shaped soft-shelled eggs of a size of about 4×1 cm.

Distribution in KNP (map 7)

Marx (1968: 32) mentions eastern Libya, Egypt and extreme southwestern Asia as the distribution of the Rogers' snake. For the KNP this is the first record of this species.

2.3.4 **Macroprotodon cucullatus cucullatus (Geoffroy 1827)**

Material and Description

Preserved specimens:
- 8 KNP 1981/...
- 1 ZSM 1983/146

During my stay at KNP, I just got one record from a road killed specimen from the area south of the watershed boundary. All other material was collected during late autumn and the winter months by Resetar or by Herbert.

Tab. 12 Sizes and lepidological features of *Macroprotodon cucullatus* from KNP's museum specimens.

No. KNP	Body Length (cm)	Tail Length (cm)	n-ventrals	n-costals	n-subcaudals	Sex
17	28.0	7.2	162	19	55	male
3400	35.3	7.0	163	19		
38	23.0	5.5				
21	37.3	8.5				
3386	13.6	2.8				
27	15.0	2.2				
-	27.3	5.7				
-	32.0	7.5				

The hooded snake has a greyish brown basic colouring with dark dorsal and lateral bars. Their arrangement is typical alternating as it is for a colubrid. The belly is pale, dark spotted or with dark brown bars which also can form a dark longitudinal stripe. The head shows the typical black "hooded" colour pattern or just a black marking on head and neck. The slightly sphenoid head is not very different from the neck and body and the general shape gives a somewhat stout impression of the animal. The pupil is vertical elyptic. The venomous teeth are located at the back of the upper jaw and are harmless to man. The body scales are unkeeled, the anal shield is divided.

Some measurements and lepidological features were taken from the KNP's specimens (tab. 12).

Biology

The hooded snake is known to be nocturnal and preying mostly on lizards. The species lays five to seven elongated eggs in July. The preferred habitat are stony or rocky landscapes with bush and shrub vegetation.

Distribution in KNP (map 7)

There are the following records for KNP (tab. 13).

Tab. 13 Sampling localities of *Macroprotodon cucullatus* at KNP.

No.	Date	Location
41	11.08.81	32°44'N/23°35'E
17	03.07.79	20 km east of Beida/Egfanta
21	18.09.79	El Faydijah
31	12.02.80	4 km west of Beida
27	07.10.79	32°42'N/21°34'E
38	15.11.80	Headquarters
42	10.09.81	2 km north of Kufanta
26	-	32°42'N/21°34'E

The above-mentioned road killed specimen was submitted to me by L. Cornwallis on 4 July 1983, from a location 4 km west-southwest of Sidi Mahammal-Al Khamri. The habitat features kindly supplied by him are: "rolling country, cultivated land and dense steppe vegetation; elevation 810 m."

2.3.5 **Malpolon monspessulanus insignitus (Geoffroy 1827)**

Material and Description

Preserved specimens:
- 9 KNP 1981/205, 291, 435, 449, 458, 496, 498, 506, 514
- 5 ZSM 1983/147, 149

This species can grow to more than 200 cm in length. After the Egyptian cobra, *Malpolon* is the biggest snake to be found in KNP. The shape of the head is very typical for this snake with the characteristic ridges over the eyes. The squamation shows dorsal medio-longitudinal furrows on the scales which overlap and are lancet-shaped. The anal shield is always undivided. Small post-nasals are mostly developed in two horizontal rows. The Libyan specimens show a high degree of variation in their colouring.

Some specimens had greyish/brown dotted patterns on their backs and others were almost uniformly black or cream to brownish green. Both unicoloured and such ones with bright dotted patterns are shown in the different ontogenetic stages. Only one specimen was uniformly cream coloured on its belly while most of them showed dark spots. Some specimens also had a dark longitudinal striped pattern on their gular part.

Some measurements and features of KNP Museum's specimens are (tab. 14):

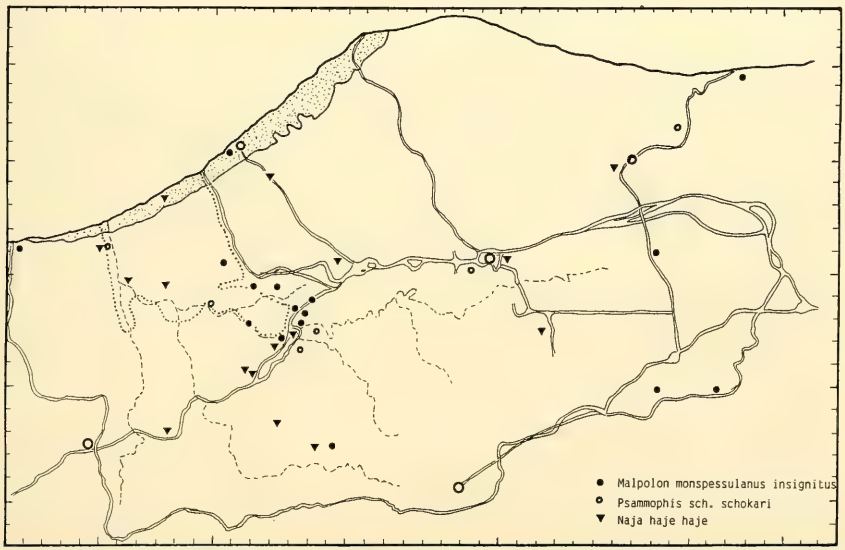
Tab. 14 Sizes and lepidological features of *Malpolon monspessulanus insignitus* from KNP's and ZSM's museum specimens.

No.	Body Length (cm)	Tail Length (cm)	n-ventrals	n-costals	n-sublab.	n-supralab.	n-subcaud.
3672	90.0	28.0	146	20	8	9	62
514	73.0	23.0	169	19	8	11	72
39	66.0	25.0	161	19	8	9	92
ZSM	80.0	29.5	151	19	8	8	97

Biology

The mating period for *Malpolon monspessulanus insignitus* is recorded to last from April to May while egg-laying takes place in July or August. The clutches contain 4–16 eggs. The hatching period is supposed to be in October.

Malpolon monspessulanus insignitus feeds on small mammals, birds, lizards and snakes. Like the Egyptian cobra it is also active during the hottest hours of the day. Most of the specimens found were housing in mouse burrows. If one tries to catch and grip the Montpellier snake it always tries to bite and to inject its venom by its chewing jaw movements. A lethal bite by a *Malpolon* has been reported.



Map 8 Observation and collecting sites of *Malpolon monspessulanus insignitus, Psammophis schokari schokari, Naja haje haje* around KNP.

Distribution in KNP (map 8)

The Montpellier snake seemed to be the most common snake in northern Libya, at least in the Jebel Akhdar region. *Malpolon* also occurred in nearly all habitats of the KNP and all ecological ranges around the park.

2.3.6 **Psammophis schokari schokari (Forskål 1775)**

Material and Description

Collected specimens:
- 2 KNP 1981/3664
- 1 ZSM 1983/148

Psammophis reaches a length of about 150 cm. Its elongated head is clearly different in diameter from the neck and body. The dorsal scalation is smooth, the squamae lancet-shaped and the anal shield is divided. One specimen in the KNP collection shows an odd type of scalation for its subcaudals. The first 13 subcaudals are divided, the following 22 undivided and the remaining posterior ones are divided again. The dorsal colouring shows one bright dorso-median length row of scales which are laterally black wedged. On the flanks brown and cream coloured stripes form the typical pattern. The belly shows a dark medio-longitudinal colouring, produced by dark medial bars from the anterior borders of the ventrals while their basic colouring is yellowish and changes laterally to a cream colouring. The length of this specimen measures 65 cm for the body and 31 cm for the tail. One hundred and eighty-five ventrals, 119 subcaudals and 17 dorso-longitudinal scale rows were counted. The other, worse preserved specimen, lacks its tail.

Biology

There is not very much known about the biology of *Psammophis schokari*. MARX's description (1958) of the genus *Psammophis* includes no biological information and most of what he mentions, relates to *Psammophis sibilans*. In captivity they were feeding on lizards and geckos exclusively.

Distribution in KNP (map 8)

Most of the specimens were caught in the higher regions of Jebel Akhdar. I found two specimens in the deep canyons of Wadi Jarjaroma where there is dense vegetation. The biggest specimen I caught was from a sun exposed south slope with trees and shrubs on the old road. It seemed that *Psammophis schokari schokari* is exclusively represented by the more uniform brownish coloured specimens in drier areas or steppe-like lands like in the regions south of the watershed.

2.3.7 **Naja haje haje (Linnaeus 1758)**

Material and Description

Collected specimens:
- 6 KNP 1919/13
  1981/272, 311, 354, 509
- 1 ZSM 1983/145

Many specimens of the Egyptian cobra could be observed during my period of field work, particularly as the cobras showed the widest temperature ranges and were also often seen during the hottest time of the day. Large specimens were found and observed at Cyrene archaeological site (Shahat) and Qasr Maqdum. From a specimen about 2 m long, I just found the sloughs from a locality close to El

Beida. One 190 cm long specimen was found killed on the road on 22 May 1983, between Kouf and Qasr Libya.

Naja haje haje possesses a big head that is clearly different in diameter from neck and body. It has big eyes with round pupils. On its back and flanks 19 to 21 rows of unkeeled scales can be counted. The cobra's teeth are rather small with a length of 8 to 10 mm even in the bigger specimens. An ontogenetic colour change seemed to be typical; in juveniles the dorsal colouring is brownish grey with black margins on the scales, the ventral side is greyish white. The head and anterior part of the body is black and irregularly dark spotted on a bright basic colouring. The back is brown with a dark brown head and a creamish brown lateral colouring.

Some measurements taken from some KNP's preserved specimens are presented (tab. 15).

Tab. 15 Sizes and lepidological features of *Naja haje haje* from KNP's museum specimens.

Body Length (cm)	Tail Length (cm)	n-ventrals	n-dorsals	n-subcaud.	n-sublab.	n-supralab.
154.0	26.0	219	20	62	8	7
160.0	30.0					
62.0	15.0	212	20	58	8	7
37.7	7.3					

Biology

As a general rule the Egyptian cobra seems to prefer staying close to old walls or ruins and sometimes remains for many years close to the same refuge or area. KNP's director Mr. Abd el Salam reported that people have known of some specimens staying for years on the same site, a good indication of this being the presence of flies around their burrows.

At least during the mating period they are supposed to live in couples close together. Copulation is said to take place for hours or even days. After a period of 60–100 days, 8–45 eggs, normally around 20, are deposited while the female mostly rests in the vicinity of the clutch. After 50–70 days of incubation the hatchlings appear. Their first sloughing takes place from 2 to 11 days after hatching, mostly before their first prey catching. Its prey consists of small mammals, birds, toads, frogs, snakes, lizards, eggs and small tortoises. After dissecting a 190 cm long road killed male (ZSM 1983/145), I found three eggs and two recently hatched young of barbary partridges *(Alectoris barbara)* in the stomach. I also found some Pentastomida in the cobra's intestines.

The Egyptian cobra was like the Montpellier snake *(Malpolon monspessulanus insignitus)* mostly seen active during the hottest hours of the days. When approaching them, the cobras always tried to escape, their flight distance was less than two to five metres. According to literature reports it was evaluated that 1 g of corbra venom would be lethal for 165 men.

Distribution in KNP (map 8)

Naja haje haje seems, after *Malpolon,* to be the most common snake in the KNP. Most of the specimens seen were between 100 and 150 cm long during those early summer months of 1983. One specimen was seen at the northeastern corner of the park close to the sea shore while Herbert (1981: 24) observed a specimen "in the sea at the mouth of Wadi Jarjaroma" on 28 July 1981 at 11h00. At El Beida slough rests were found in a fissure cave from a specimen of approximately 2 m in length.

2.3.8 Cerastes spec.

One unproven information on a small horned snake – supposed to be *Cerastes cerastes* (L.) – in the park was given by a shepherd whom Mr. H. S. Horrier and I met on a field trip to the northwestern corner of the watershed area. This native mentioned that he occasionally saw small snakes with horns in the sand at this area close to the beach.

Chapter 3 – Ecology

Most of the known ecological data or information (e. g. prey items) or habitat conditions (e. g. the salt content or chemo-physical analyses of the anuran's habitats) are given in the chapters containing the systematic descriptions. The habitat descriptions are roughly summarized in Chapter 1. It is important to have information on soil moisture and temperatures for the development of the incubated eggs and for the reproductivities (see there the different stations, e. g. for sea turtles nests with information on sand moisture up to 100 cm). Climatological data on temperatures of air and soil, hours of sunshine, precipitation, etc. are presented in tabs. 16 and 17.

3.1 Predators

Possible predators for the different amphibians and reptiles, as well as some important mammals and birds occurring in the KNP are listed below. The list of birds being potential predators was kindly submitted by Dr. L. Cornwallis.

3.1.1 Mammals

Hyaenas, common jackal, wild dogs, hedgehog, porcupines, cats, human beings.

3.1.2 Birds

Little owl, European kestrel, African hobby, gold owl, Montagu's harrier, African hawk eagle, short-toed eagle (was often seen catching snakes as it is specialized on this prey), Verreaux' eagle, Bonelli's eagle, golden eagle, black kite, Lanner falcon, peregrine, lesser kestrel, kestrel, hopooe, kingfisher, black stork, white stork, little egret, squacco heron, night heron, grey heron, pelican, herring gulls and other water birds, cream-coloured courser and great grey shrike.

3.2 Climatological Information[1])

The climatological data presented here show the important ecological-climatological differences of various habitats in different areas of KNP. For this purpose general data are presented: relative humidity, total rainfall, sunshine hours, and minimum, maximum and average monthly temperatures for one representative year. More detailed data, such as different temperatures at different hours of the day, reflect the heating or warming possibilities for the reptiles. The data on soil temperatures are given because they are important for the reproduction and incubation of the reptilian eggs at their different depths, and also allow possible interpretations of micro-climatological conditions for soil dwelling reptiles. The data on soil moisture give information for the moisture of the ground at different stations and for different soil types (important for instance at station "3" for the sea turtles nesting on the beach).

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[1]) Climatological stations in KNP watershed area (see fig. 1).

The data were taken from several stations over a period of 13 months, from January 1982 to January 1983. There are two climatological stations: one at 500 m, the elevation of the KNP's offices (I-KOUF) and the other at 200 m, at Barthamedo (II-Barthamedo). Also on I-KOUF soil temperatures were measured for the same period at 5, 10, 20, 50 and 100 cm. – For the soil moistures, I present here records from four selected stations: Station 1 is at the same location as I-KOUF, Station 2 at the same location as II-Barthamedo, Station 3 is located on the beach (representative of the sea turtle nests) and Station 4 is in the shade (on a south slope along the old road) to demonstrate soil conditions which should be most similar for buried clutches in shady conditions. Stations 1 and 2 are fully exposed to the sun. The soil types are loamy. On Station 3 there is a sandy beach.

Tab. 16 One year's climatological data from 2 stations at KNP; location see fig. 1.

Climatological Station I-KOUF

	Jan82	Feb82	Mar82	Apr82	May82	Jun82	Jul82	Aug82	Sep82	Oct82	Nov82	Dec82	Jan83
Relative humidity-air (%)	71	77	70	59	58	56	67	65	70	62	74	77	86
Total rainfall (mm)	35.2	105.5	43.0	22.6	2.7	0.0	0.0	0.0	6.5	7.4	34.4	94.3	140.4
Sunshine hours (0 m)	5.6	4.1	5.6	5.7	9.0	11.3	10.6	9.8	9.1	6.5	6.5	3.6	3.9
Temperatures													
- at 02h00	9.2	7.4	8.6	14.8	16.9	21.9	19.2	20.4	17.7	17.8	10.6	9.1	7.2
- at 05h00	13.4	10.7	12.6	18.8	22.0	26.8	18.3	19.4	16.4	17.1	10.3	8.7	7.1
- at 08h00	14.6	11.4	14.2	19.8	22.6	27.2	22.5	23.2	20.3	19.1	11.1	8.7	7.3
- at 11h00	13.1	10.5	12.6	17.8	20.8	25.3	27.2	29.0	26.4	25.2	16.8	12.4	10.2
- at 14h00	10.4	8.7	10.0	14.7	16.7	20.8	27.8	29.2	26.7	26.1	17.3	13.2	10.8
- at 17h00	9.7	7.8	8.9	13.5	14.6	18.5	26.2	27.7	24.2	23.7	15.1	11.4	9.7
- at 20h00	9.4	7.5	7.7	12.4	13.1	16.8	22.1	23.8	20.7	20.0	12.5	9.8	8.2
- at 23h00	9.2	7.3	7.3	11.9	12.4	15.7	20.4	21.7	19.0	18.3	11.0	9.2	7.7
Daily temperatures/ month	11.1	8.9	10.2	15.5	17.4	21.6	23.0	24.3	21.5	20.9	13.1	10.3	8.5
Minimum/month	7.9	5.8	6.2	10.1	11.4	15.0	17.8	18.9	16.1	16.0	8.8	7.4	6.1
Maximum/month	15.6	12.8	15.3	21.0	23.8	28.4	28.8	30.7	27.8	27.5	18.6	14.5	11.7
Minimum absolute	3.8	1.4	1.8	4.0	4.1	9.7	13.4	15.3	11.7	12.2	5.0	2.0	2.0
Maximum absolute	22.7	18.1	30.3	31.3	34.5	37.0	32.7	39.7	34.9	36.6	23.0	22.2	16.0

Climatological Station II-Barthamedo

	Jan82	Feb82	Mar82	Apr82	May82	Jun82	Jul82	Aug82	Sep82	Oct82	Nov82	Dec82	Jan83
Relative humidity-air (%)	71	75	73	66	68	67	81	79	78	63	68	70	81
Total rainfall (mm)	23.9	86.3	35.7	13.9	2.9	0.0	0.0	0.0	21.0	12.0	36.4	82.9	119.2
Sunshine hours (0 m)	5.7	4.0	6.0	5.7	9.0	11.1	10.3	9.2	8.8	6.6	6.2	3.5	3.0
Temperatures													
- at 02h00	11.3	9.3	9.8	14.2	15.1	19.1	21.3	22.5	19.8	20.0	12.4	10.9	8.9
- at 05h00	11.3	8.9	9.4	13.7	15.0	18.0	20.5	21.7	18.7	19.3	12.1	10.2	8.8
- at 08h00	11.0	9.2	10.6	16.1	18.5	23.1	24.4	25.0	22.1	21.5	13.3	10.4	8.9
- at 11h00	14.7	12.4	14.1	19.7	22.6	26.6	27.2	28.8	27.1	27.4	19.2	14.1	12.0
- at 14h00	16.0	13.2	15.5	20.3	22.9	27.1	27.8	29.2	26.3	27.5	19.2	15.0	13.0
- at 17h00	14.6	11.9	14.2	18.5	21.8	25.7	26.6	27.8	25.2	24.9	15.7	13.0	11.8
- at 20h00	12.2	10.0	11.3	15.9	18.4	22.5	24.5	25.2	22.1	21.1	14.4	11.6	9.9
- at 23h00	11.9	9.4	10.7	14.6	16.2	20.1	22.2	23.5	20.6	20.6	12.7	11.0	9.4
Daily temperatures/ month	12.8	10.5	12.0	16.6	18.8	22.7	24.7	25.5	22.8	22.8	15.0	12.0	10.4
Minimum/month	9.6	7.6	8.3	12.1	13.9	17.3	20.0	21.1	18.3	17.9	10.5	8.8	7.5
Maximum/month	17.1	14.4	16.5	21.9	24.2	28.3	28.8	30.6	28.3	29.4	20.8	16.3	14.3
Minimum absolute	14.8	3.9	4.5	6.9	8.4	13.3	16.8	18.8	14.5	13.3	7.3	3.3	2.2
Maximum absolute	23.0	19.4	30.2	31.9	34.6	36.7	31.8	41.0	34.2	39.9	26.1	24.0	19.5

3.3 Soil moistures

The data of the soil moistures (in %) were kindly submitted by Ing. M. Yasin. The four stations (see fig. 1) presented here are:

- Station 1: I-KOUF at KNP's campsite
- Station 2: Barthamedo
- Station 3: Beach
- Station 4: Old Road

Stations 1 and 2 are surrounded by Mediterranean shrub vegetation like Juniperus, Arbutus and Sarcopoterium. Station 3 is covered by sea-water during the winter, approximately 150 m south of the coastline, situated at an elevation between 0 and 10 m above sea level. Station 4 is completely shaded by Juniperus trees.

Tab. 17 Soil conditions (moistures) from 4 stations at KNP (see fig. 1) and soil temperatures from climatological station I-Kouf.

Soil Moistures in %

DATES	STATION 1 Depth in cm 0-10, 10-20	STATION 2 Depth in cm 0-10, 10-20 20-30, 30-40	STATION 3 Depth in cm 0-10, 20-30 40-50, 60-70
16.06.82	2.9	5.3	10.5
	7.0	9.8	17.8
		12.8	18.6
		14.7	21.1
27.07.82	3.0	6.6	22.4
	6.7	10.2	25.0
		11.7	28.0
		11.8	27.9
16.07.82	5.8	4.8	21.0
	7.4	8.8	22.2
		11.5	24.1
		14.3	26.8
01.08.82	3.9	6.2	20.2
	7.5	8.2	23.7
		10.7	24.4
		12.6	27.7
15.08.82	4.4	5.8	23.5
	6.9	10.0	27.4
		14.1	28.3
		16.3	29.5
01.09.82	3.4	6.4	19.4
	6.2	9.7	22.9
		12.2	27.0
		12.3	28.6
15.09.82	3.5	6.5	23.5
	5.3	7.8	24.7
		11.3	25.6
		10.0	27.7
01.10.82	4.4	10.2	22.9
	6.1	11.7	25.4
		13.1	26.2
		14.5	27.5
16.10.82	6.2	6.6	21.3
	6.9	11.6	25.8
		12.9	27.9
		14.0	28.4
01.11.82	2.9	7.0	17.5
	6.5	9.3	21.5
		12.0	23.7
		13.0	25.7
15.11.82	4.2	11.0	22.7
	6.2	12.8	32.4
		14.3	25.5
		16.6	27.2

DATES	STATION 1 Depth in cm 0-10, 10-20	STATION 2 Depth in cm 0-10, 10-20 20-30, 30-40	STATION 3 Depth in cm 0-10, 20-30 40-50, 60-70	STATION 4 Depth in cm 0-10. 10-20 20-30
09.03.83				36.4
				29.9
				28.1
16.03.83				19.2
				24.3
				27.9
01.04.83	8.1	17.0	30.3	
	14.2	18.2	31.8	
		19.3	30.6	
		19.6	29.3	
02.04.83				16.8
				22.7
				25.0
15.04.83	5.1	14.2	28.2	
	12.8	15.2	29.4	
		16.6	29.5	
		17.6	30.1	
16.04.83				25.4
				21.5
				22.3
01.05.83	3.7	9.3	27.6	17.3
	10.4	12.7	26.5	21.6
		14.3	27.8	21.3
		15.2	28.3	
15.05.83	2.7	5.4	28.1	18.9
	7.6	12.1	26.0	21.7
		14.1	29.8	21.0
		15.1	30.2	
01.06.83	3.3	7.3	23.4	14.3
	8.8	11.3	26.2	18.8
		14.3	27.9	20.4
		16.0	30.8	
16.06.83	5.1	7.5	25.7	15.4
	7.6	11.4	26.7	19.8
		13.2	26.3	19.9
		14.4	25.7	
01.07.83	2.8	8.4	23.4	14.0
	6.8	12.9	25.2	19.3
		13.6	25.9	19.6
		14.9	27.0	

Soil Temperatures - Station I-KOUF

Time	Depth	Jan82	Feb82	Mar82	Apr82	May82	Jun82	Jul82	Aug82	Sep82	Oct82	Nov82	Dec82	Jan83
08h00	5cm	8.8	7.8	9.3	14.1	17.1	22.2	24.1	24.6	21.5	19.6	12.3	8.8	7.6
	10cm	9.5	8.2	9.8	14.5	17.8	22.7	14.6	25.1	22.2	20.2	12.9	9.4	7.9
	20cm	10.9	9.5	11.1	16.0	19.2	23.8	26.0	26.5	23.9	21.8	15.2	11.2	9.4
	50cm	13.1	11.4	12.5	16.2	19.0	22.7	24.9	25.7	24.3	22.5	17.8	13.9	11.7
	100cm	14.4	13.0	13.1	15.2	17.3	20.0	22.2	23.3	23.7	22.0	19.3	16.2	13.8
14h00	5cm	11.7	10.4	12.8	18.6	23.2	29.5	30.4	30.8	27.5	24.3	15.9	11.3	9.3
	10cm	11.5	10.0	12.4	18.0	19.6	28.0	28.7	29.2	26.1	23.4	15.5	11.0	9.2
	20cm	11.0	9.6	11.3	16.1	20.0	24.9	26.1	26.7	24.2	22.1	15.3	11.2	9.4
	50cm	13.1	11.5	12.4	15.8	19.0	20.0	24.8	25.7	24.2	22.5	17.8	13.9	11.6
	100cm	14.4	13.0	13.1	15.2	17.3	20.0	22.3	23.4	23.0	22.0	19.3	16.1	13.7
20h00	5cm	11.4	10.3	13.0	18.0	23.1	29.2	30.3	30.7	26.9	23.5	15.4	10.9	9.5
	10cm	11.8	10.5	13.3	18.5	23.7	28.8	30.2	30.6	27.1	23.9	15.8	11.3	9.8
	20cm	11.8	10.4	12.5	17.4	21.8	26.6	28.0	28.5	25.9	23.1	16.2	11.8	10.0
	50cm	13.0	11.5	12.5	16.2	18.9	22.6	24.8	25.6	24.1	22.4	17.8	13.9	11.8
	100cm	14.4	12.9	13.1	15.2	17.3	19.4	22.3	23.4	22.9	21.9	19.3	16.2	13.8

The horizons of the stations for their readings are (in cm):

- Station 1: 0–10, 10–20, 20–30, 30–40, 40–50, 60–70
- Station 2: 0–10, 10–20, 20–30, 30–40, 40–50, 60–70
- Station 3: 0–10, 20–30, 40–50, 60–70
- Station 4: 0–10, 10–20, 20–30.

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